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TEXAS AGRICULTURAL EXPERIMENT STATION

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS
W. B. BIZZELL, President

THIRTY-THIRD ANNUAL REPORT

1920

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COLLEGE STATION, BRAZOS COUNTY, TEXAS

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†As of August 1, 1921.
*In cooperation with School of Veterinary Medicine, A. and M. College of Texas.
**In cooperation with United States Department of Agriculture.

THIRTY-THIRD ANNUAL REPORT

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B. YOUNGBLOOD, DIRECTOR*

INTRODUCTION

Texas ranks first in agricultural production, valuing her products at more than $725,000,000 annually. No other state and no other area of similar extent presents such a variety of soils and climate, nor such an array of agricultural opportunities. The genius of her sons has been directed toward the scientific uses of this effulgent natural wealth. The limitless agricultural possibilities of her vast area have long been recognized, and marvelous uses have been made of this teeming wealth. Texas has recognized the value of her soil as a wealth producer. With the application of science to the promotion of agriculture, she is annually increasing the value of her products. The increasing number of new farms has been a factor in the value of her production, but these have been made possible by the development of the science of agriculture and the management of the new lands and the utilization of improved or newly introduced crops suited to them.

Research, the source of all reliable agricultural information, has played a significant part in supplying the knowledge to guide the sons of Texas in making valuable to her farmers and stockmen the wonderful variety of soil and climatic resources found within her borders. The greatest need in further developing the vast resources of the State is the vigorous and active prosecution of agricultural research, and the utilization of sound and reliable agricultural information which has been developed through research. Such disseminating agencies as the Extension Service of the A. and M. College, the A. and M. School of Agriculture, and the junior agricultural colleges for the instruction of students; all State supported agencies disseminating agricultural information; the press of the State, and all individual and collective activities are in this way able to function fully.

THE FIGHT ON ANIMAL DISEASES

Animal diseases cause heavy annual losses to the live stock grower, and also limit the production of man's animal food. Animal diseases may also be the means of communicating to man such diseases as tuberculosis, typhoid fever, and other malignant ills. Animal diseases, such as anthrax, hydrophobia, and so forth, are directly communicable to man. Animal diseases, therefore, affect not only the wealth, but also the health and happiness of the people, and must be combated.

*This report was written by Vice Director A. B. Conner, for the Director.

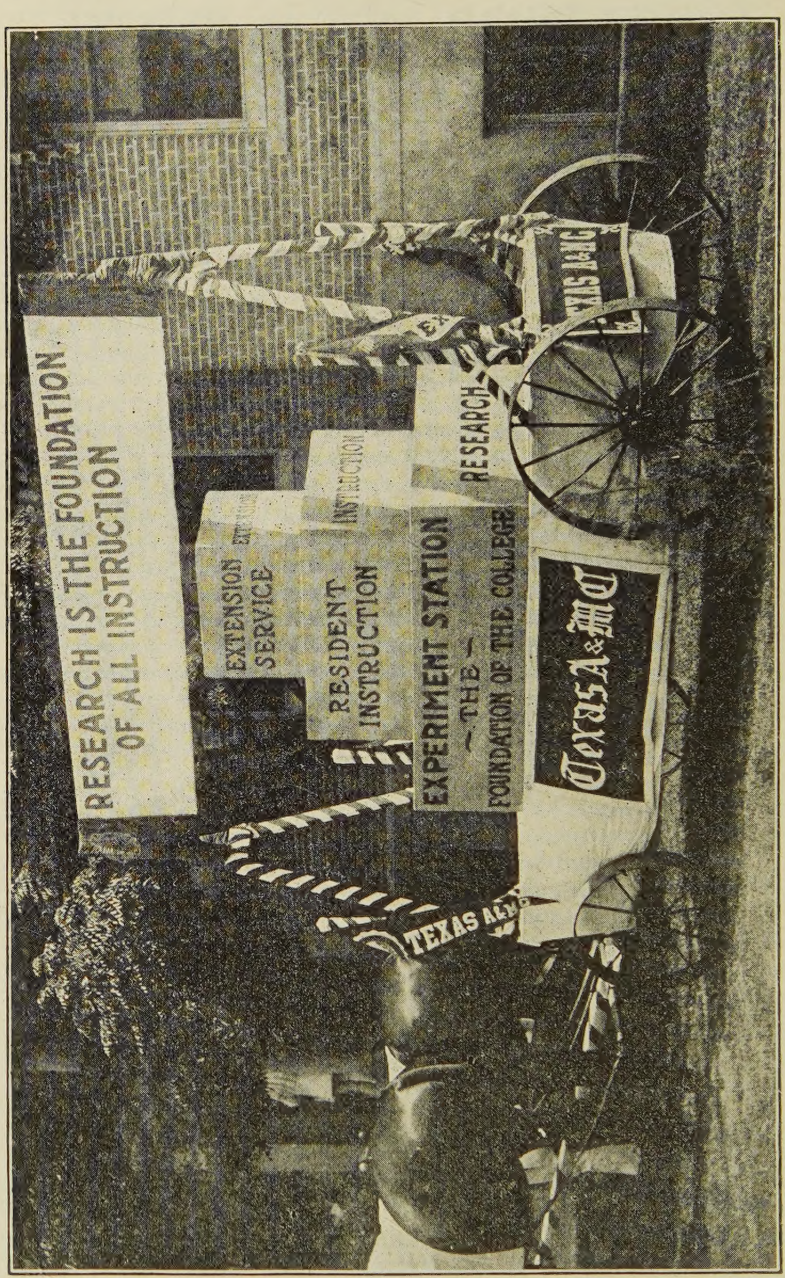
RESEARCH IS THE FOUNDATION OF ALL INSTRUCTION
EXTENSION SERVICE
RESIDENT INSTRUCTION
EXPERIMENT STATION
— THE —
FOUNDATION OF THE COLLEGE
RESEARCH
TEXAS A&M

Figure 1.

The veterinarian, with his serums, vaccines, disinfectants, sanitary measures, and medicines, can wield a tremendous influence upon the well-being of all animal life, and without the knowledge and skill gained through veterinary research, man would indeed be in a sorry plight. Veterinary research has provided adequate measures for combating Texas fever, both by immunization and by destroying the tick that causes the fever. Veterinary research has found effective measures of controlling anthrax and blackleg. Veterinary research, by the development of hog cholera serum, has made the hog raiser practically safe from the devastation of his herds by cholera. The live stock husbandman yet encounters certain diseases, such as swell head of sheep and goats, swamp fever of horses and mules, the loin disease of cattle, and other troubles which veterinary research has not yet been able to successfully combat. There can be no question, however, that all animal diseases can be controlled effectively if a sufficient fund of knowledge is at hand to allow correct procedure. Animal diseases must be combated.

SWELL HEAD OF SHEEP AND GOATS

Swell head is a well known disease affecting sheep and goats throughout the western part of the State, and extends northward to Canada, occurring more or less irregularly from year to year, for the most part during the late fall, winter, and early spring. The symptoms of the diseases are: During the first four or five days of attack a highly discolored urine is voided with much difficulty; there is a yellowish discoloration of the mucus membrane of the eye, mouth, and skin; a loss of appetite, with a dirty, sticky discharge from the swollen eyes and nostrils, attended by a swelling of the lips and the head. A serous fluid usually oozes from the swelling, which gradually dries up on the surface, turning into a brownish mass in case the animal recovers. (Death usually follows in four to seven days from the time of first affection.) The skin of the affected parts undergoes dry necrosis, and later peels off, leaving a newly formed skin beneath. During the early stages of the disease there appears at the base of the horns and hoofs a dark red line due to blood congestion.

The disease is more disastrous to goats than to sheep, and the losses of goats are oftentimes considerable. It is thought by many that the disease is due to the animal eating poisonous plants on the range. Others hold that it is an infectious trouble, but thus far no one has succeeded in determining the cause.

Experiments made for the transmission of the trouble to healthy goats by means of blood inoculation and by the injection of bile from sick into healthy goats have failed to reproduce the trouble. Likewise, attempts to transmit it by subjecting well animals to contact with affected animals have failed entirely to transmit it.

Numerous animals have been subjected to post-mortem examinations and careful records have been made of the appearance and condition of all of the principal organs without finding anything abnormal other than the yellowish discoloration of all internal organs. It is noteworthy, however, that impactions of the caecum and rumen are found

in most cases. It is not now known whether this impaction of the caecum is a cause or an effect of the trouble.

During the past year a poison squad of goats has been established at Substation No. 14, near Sonora, Texas, with the intention of forcibly feeding the animals on different plants suspected of having poisonous effects. This poison squad will be continued, seeking not only for the poisonous qualities of the plants, but the effects when eaten by the animal, and this should prove of great value to the sheep and goat raisers of the State in determining what relation, if any, exists between certain plants on the range and sheep and goat troubles occurring from time to time. In this work careful notes and records will be obtained on the laxative or constipating effect of different plants and whether these effects are intimately associated with swell head or some other trouble.

The best mode of attack for this problem seems to lie in the systematic elimination of suspected causes, one after another, until something definite is known. It is certain that this disease is taking toll of a large number of animals in Texas each year.

SWAMP FEVER OF HORSES AND MULES TRANSMITTED BY THE STABLE-FLY?

Recent work with swamp fever, or *Infectious anaemia,* of horses and mules, wherein a healthy horse enclosed in a screened barn with one affected with swamp fever and with the presence of stable flies, developed strong fever reactions, indicating that the stable-fly plays an important role in the transmission of the disease.

The presence of swamp fever is usually indicated by voracious appetite, rapid fatigue when being worked, lack of vigor, loss of flesh, followed by extreme emaciation and resulting finally in the death of the animal. No effective means of control are known at the present time, and only meager information is available as to the cause of the disease and the methods of transmission.

The disease is prevalent throughout the Gulf coastal plains and other parts of Texas. In 1916 it appeared to be of such economic importance that research studies were undertaken to determine the cause or causes of the disease and methods of control. The virulency of the virus seems to vary under different climatic conditions.

The disease was prevalent in the artillery and cavalry of the armies in the battlefields during the late world war to such an extent that artillery and cavalry operations were greatly handicapped.

The annual losses of farm animals from this disease have been so great that systematic and thorough study of the disease and methods of control are most urgent, and the work must be persistently continued.

STOMACH WORMS IN SHEEP AND GOATS

Stomach worms are prevalent in sheep and goats throughout the State, and cause most serious losses in the low-lying districts wherein the rainfall is quite heavy, during the late summer and early fall, and especially with lambs. The stomach worm problem is undoubtedly the greatest handicap confronting the sheep and goat industry there. The symptoms are great emaciation, weakened condition, and a dry parchment condition of the skin, finally resulting in death. Extensive ex-

periments have been under way to determine effective means of controlling the stomach worm by treatments with copper sulphate and sodium arsenite in combination. Sodium arsenite used in various combinations has proved so poisonous that it was found impractical as a means of treatment. Copper sulphate treatments have not been wholly satisfactory, due to the fact that it is difficult to determine the extent of infestation in the treated animal and the efficiency of the dose. It is planned to take large numbers of animals, make the treatments, kill the animals, and make thorough examination for infestation, and while this means is more or less expensive, it will effectively tell whether or not copper sulphate is an efficient remedy.

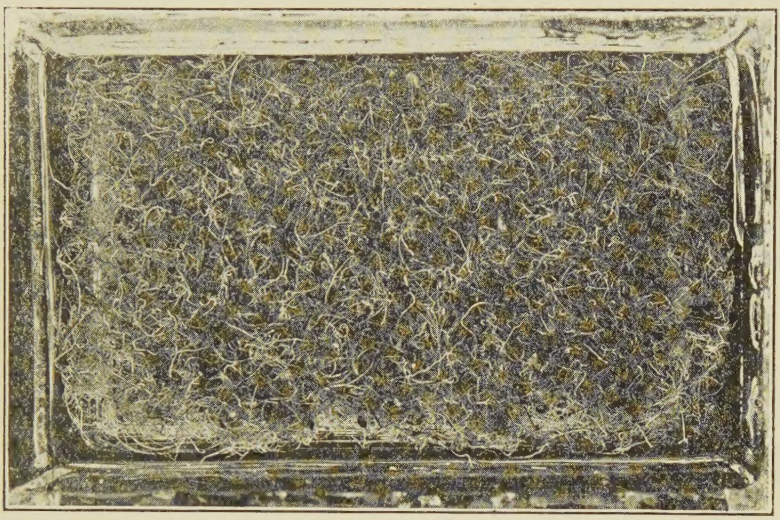

Figure 2.—A mass of stomach worms taken from stomach of a single sheep.

TICK FEVER OR TEXAS FEVER

Tick fever immunization work has, during the past year, embraced the immunization of 107 fine-blooded breeding cattle for Texas stockmen and farmers. The Division, in addition to the immunization done here at College Station, has sent out 380 doses of virus to forty different parties in the State. Up to the present time approximately 3400 animals have been immunized against tick fever at College Station, besides hundreds of doses of the virus which have been sent out in past years. The process for immunization against tick fever has been very largely developed by this Station, and has served the owners of both beef and dairy cattle, as a means of allowing them to procure better blooded animals during a period when two-thirds of the State was infested with the cattle tick. With the elimination of the cattle tick, which has been hastened materially by the use of this process in securing and demonstrating the high value of better blooded cattle, the use of the process will be limited, necessarily, practically to the treatment of cattle in case of outbreaks which may occur from time to time. Such outbreaks of

tick fever are likely to occur until the cattle tick has been completely eliminated.

LOIN DISEASE, OR DOWN-IN-THE-BACK TROUBLE, OF CATTLE

A mysterious disease of cattle has been prevalent in more or less widespread outbreaks in the Gulf coastal plains for several years. The disease usually manifests itself in a wobbling or unsteady gait when the animal is walking, followed very shortly by paralysis of the muscles controlling the loins and hind quarters. At this stage, the animal gets down and is unable to get up. The tail is paralyzed. Within a day, the trouble seems to extend to the muscles of the neck, and the animal is unable to hold its head up. If the animal is on the range, and is not provided with shade, it is likely to die. In certain cases, where shade has been provided and the animal has been fed and watered, recovery has been noted, but many cases are found where recovery is attended by a regaining of control of the muscles of the neck first, and later the first muscles affected. Numerous animals have been "posted," and infectious agents have been diligently sought for, but without definite results. This trouble each year causes the loss of thousands of head of cattle, and for that reason it is one of the most expensive diseases the stockmen of the State have to face.

This project was begun in 1916. Many post-mortem examinations have been made, and in typically developed cases the internal organs have always been found normal. Blood stains and smears from liver, heart, brain, and other parts of the animal, have been prepared and examined.* Attempts have been made to transmit the disease to rabbits and guinea pigs, and also to cows, by injections of blood, but negative results have been obtained. Attempts are being made to systematically study the plants on the range where cattle are found infected with this disease, and in connection with it studies are also being made of the flies and other insects which may be responsible in part, at least, for its spread. It is an exceedingly important problem, now causing losses of thousands of dollars annually, and seriously threatens the live stock industry in the coastal plains of Texas.

THE HORTICULTURAL SPECIALIST AIDS THE CITIZEN TO LIVE CHEAPER AND BETTER

Fruits, vegetables, and flowers play an important role in the health and happiness of mankind. Fruits and vegetables for home use provide a variety of food necessary to the proper nutrition and health of the family. Flowers and ornamental trees and shrubs are universally demanded. The many distinct agricultural regions in Texas, each varying in soil and climatic conditions, present to the citizens in every section horticultural problems of much importance. What fruits and vegetables to

*Since the close of the fiscal year, but before the publication of this report, an organism has been found by Dr. H. Schmidt, Station Veterinarian, present in smears taken from animals affected with this disease. This organism has not yet been determined to be the cause of the disease.

grow under these varying conditions, and how to grow them, constitute information that is necessary to make the home garden provide the home with every necessity. During the recent period of high prices of every kind of foodstuff, the people everywhere realized that the home garden, with its variety of fruits and vegetables, was a major and not a minor factor in the matter of supplying the family with food at a limited cost. A properly managed home garden will cut table expenses in half, and is exceedingly profitable and desirable, either when foods are high or low in price, as it allows the thrifty people to save more money. The lack of information as to the qualities and characters of different varieties of fruits and vegetables, their needs and requirements, their proper management and utilization, is perhaps the greatest single factor in limiting the production of these important and staple articles.

OBTAINING HARDIER PEACH STOCK

Experiments to determine the longevity of peach stock have shown a lower percentage of mortality in the Indian Cling than in any other of several varieties tested. The results, however, may be considered as only preliminary, as the death loss is not heavy until the trees have reached several years of age.

EXTENDING THE GRAPE-GROWING REGION

Experiments have been under way to test the comparative hardiness of different varieties of grapes as compared to the same varieties grafted on to *Vitis champinii* stock, a hardy native species, closely related to the mustang grape. The plats where these tests have been made are not provided with the best of drainage, and many vines have consequently died. In every case, however, the varieties growing on their own roots died first. Those living and producing at the present time are all grafted on to *Vitis champinii stock*. This would indicate much greater hardiness of the native stock, which, if used on suitable soil, should greatly extend the grape-growing region of the State. Experiments will be enlarged, with a view to getting full and complete data.

THE A. & M. BERRY

A new berry has been produced by H. Ness, Chief of the Division of Horticulture, by hybridization of the dewberry and the raspberry. This berry possesses so many unusual qualities that it is now being rapidly increased for distribution among the citizens of the State. The plant is a vigorous grower, with large stems, or canes; large round, thick leaves, and produces a dark-red or crimson colored berry of unusual size and flavor. It has the most desirable habit of fruiting for at least four months during the year, making it one of the most desirable berries for the home garden. It has been named the "A. & M. Berry."

In the development of this berry by means of hybridization, a peculiar trait of almost complete sterility in the first generation was observed, which disappeared as suddenly in the second generation.

Figure 3.—The "A. and M. Berry"—a hybrid between Brilliant raspberry and Louisiana dewberry. Developed by the Division of Horticulture.

SPECIAL INVESTIGATIONS OF ROSACEOUS FRUITS

One of the largest collections of peach stocks to be found in the United States has been assembled and planted at Substation No. 2, located near Troup. This collection includes not only the many varieties found in the United States, but also many introduced from other parts of the world. This enterprise has been made possible because of

Figure 4.—Three-year-old peach orchard at Substation No. 2, Troup. Part of a large collection of peaches planted here.

a cooperative agreement with the Bureau of Plant Industry, United States Department of Agriculture, through which many new introductions have been received and planted. The condition of the peach industry in this State is such that more or less irregularity in crops obtains, which, it is believed, can be largely obviated either by finding better stocks or varieties more able to evade conditions now causing great loss to the peach growers.

Plantings of prunes, plums and berries have also been made, in the search of more successful varieties.

SEARCH FOR BEST SOURCE OF SEED POTATOES

Practically all of the seed Irish potatoes planted in Texas is imported from other states. It then becomes a matter of importance and value to the farmer and potato grower to know the best source of seed potatoes from which to grow his crop.

Experiments were conducted during the year at College Station and at Troup, in which seed potatoes were introduced from all the principal seed-producing regions. In this one year's test, the Wisconsin and Nebraska seed potatoes gave the best results, but further work will be necessary before conclusive information can be given. Cooperation with the Bureau of Plant Industry, United States Department of Agriculture, has enabled the obtaining of seed from the several regions.

WIDELY DISTRIBUTED GARDEN AND VEGETABLE TESTS

Numerous tests with the many varieties of garden vegetables are being made at all of the substations, for the purpose of securing information as to the suitability of the different vegetable crops for the different regions and the varieties most useful in the home garden.

THE PROFOUND INFLUENCE OF CHEMISTRY ON AGRICULTURE

The farmer, the housewife, the dairyman, the feed manufacturer, the fertilizer manufacturer, and every scientific explorer, are all dependent upon the chemist. The chemist must determine the composition of soils, the air, and the water. By his findings the farmer rates the value of his barnyard manure and the commercial fertilizers which he buys; from the chemist, the farmer learns the composition of his plants and their relation to animal life; he learns of insecticides and fungicides that he may protect his crops from the ravages of diseases and insects. The balanced ration was impossible until the chemist mastered the problem and the farmer could not feed his animals with economy until the chemist had determined what the animal needs and in what feeding stuffs those elements could be found.

The housewife can learn from the chemist how to prepare from the stores at hand a wholesome meal that will keep her children growing and her men folk healthy. From the chemist she also has learned to preserve her fruits and vegetables, her

eggs, and her butter, in order that she may serve them unexpectedly out of season.

The dairyman has learned from the chemist, not only what to feed and how to feed it, but how to value his milk from the fat content.

The fertilizer manufacturers by the aid of the chemist have been able to prepare concentrated fertilizers which, owing to their compactness and availability, may easily be transported and substituted economically where shortages occur in the supplies of barnyard manures or where need exists for use of large supplies of plant food.

The feed manufacturers have learned how to manufacture balanced rations for horses, cows, pigs, and other animals and to utilize feeding stuffs which would otherwise go to waste.

The scientific investigators all need the chemist. The soil surveyor classifies the soil, but the chemist determines its analysis. The scientific animal husbandman gets a chemical analysis of every feed he tests. The veterinarian must have analyses of plants suspected of poisonous qualities and many of his explorations rest upon the chemical analyses and reactions of specimens he is studying. The plant pathologist is continuously poring over chemical reactions, for the diseases affecting plants and possible remedies for these diseases are all interwoven with the mysteries of the chemist's bowl.

CHEMICAL COMPOSITION SHOWS SOIL FERTILITY

The importance of securing exact information as to the composition and needs of Texas soils for increasing and maintaining their fertility is evident to all. Chemical studies and pot experiments have shown that there is a closer relation between the active phosphoric acid of the soil and the results of pot experiments than between the total phosphoric acid and pot experiments. The phosphoric acid of surface soils is on an average more available than the phosphoric acid of subsoils, and more available in non-acid than in acid soils, but this relation does not hold in all cases. Phosphoric acid is needed by many Texas soils.

REMOVAL OF POTASH BY CROPS SHOWN BY EXPERIMENTS

Experiments during the past year have shown that the removal of potash by crops can, to some extent, be followed by means of chemical methods, thus opening a new method of study of the removal of potash by crops.

ACQUAINTANCE WITH SOIL TYPES IS VALUABLE TO MANY

Soil types are mapped and described by the Division of Soil Survey of the Texas Agricultural Experiment Station, cooperating with the Bureau of Soils. Samples of soil types are collected for study of the chemical composition, as this gives information as to the needs of these different types for plant food and indicates the methods of supplying it. During the past year samples were sent in by the Division of Soil Survey from the following counties: Lamb, Hale, Terry, Bailey,

Hardeman, Haskell, Dickens, Knox, Foard, and Red River. The systematic study of these soils has been of great value to many people and it is a kind of work that is of permanent value.

HELPING THE FARMER TO STUDY THE NEEDS OF HIS SOIL

Cooperative fertilizer experiments have been resumed after a lapse of several years due to war conditions. Fertilizers have been sent out to fifty farmers so that each, by applying different fertilizers to ten different plats of ground, can see for himself the effect of the different mixtures upon his soils. Aside from giving the farmer an opportunity of becoming acquainted with fertilizers on his own land, these experiments furnish material for the study of the relation of crop yield, chemical analysis, and pot experiments on soils. In cases where soil types have been classified and have been studied in the laboratory, these pot experiments supply the most reliable index for advice as to fertilizers needed wherever the particular soil type is found in a region not differing widely in climatic factors.

IRRIGATION WATER SOMETIMES DANGEROUS

Not every water supply is suitable for irrigation purposes, and hence it is advisable to have an analysis made of water proposed to be used for irrigation before investing any considerable sum of money in land, machinery, or equipment. This is especially true if there is any doubt whatever as to the character of the water. The Division of Chemistry of the Texas Agricultural Experiment Station has analyzed a large number of samples of irrigation water during the past year, determining the suitability for the purpose. It is believed that in some cases considerable sums of money have been saved where water samples were found to be dangerous.

EXACT INFORMATION AS TO VALUES OF FEEDING STUFFS SECURED

A study of the feeding values of different feeding stuffs has been continued to some extent under difficulties. Digestion experiments were made chiefly with wheat by-products, together with the estimation of sugars and starches of a number of feeds. Among these feeds studied this year are wheat bran, wheat brown shorts, wheat white shorts, whole wheat, sesame cake, and red top cane seed. More than 120 digestion experiments have now been conducted by the Division of Chemistry of the Texas Agricultural Experiment Station. Exact methods of determining the feeding value as well as the relation of the feeding value to the commercial value have been worked out, thus enabling the Division to supply the many inquiring persons and agencies with information desired, concerning the relative values of various feeding stuffs when fed to animals.

CHEMICAL ANALYSIS AIDS IN THE STUDY OF LIVE STOCK PROBLEMS

The knowledge of the chemical composition of feeding stuffs used in feeding experiments is very important, for unless the chemical analysis is made, no one will know whether the feeds used are better than the

average or poorer than the average. The mere assumption that feeds are of a certain quality or a judgment of quality by the eye, is not a suitable method for scientific work. The Division of Chemistry has cooperated with the Division of Animal Industry in making for that Division a large number of analyses of feeding stuffs used in feed lot experiments. It has also provided the Division of Animal Industry with the melting point and iodine numbers of 100 samples of hog fat taken in connection with the study of the soft pork problem by the swine husbandman.

Figure 5.—A sheep used in digestion experiments, Division of Chemistry. Showing harness used for collection of excrement.

MIXED FEEDS SOMETIMES ADULTERATED WITH SALT

It sometimes occurs that mixed feeds are placed on the market, containing an excess of salt. A method for determining the salt present has been devised and the salt content studied in a number of commercial feeds. This checking of salt used as an adulterant enables the Division of Feed Control Service to properly administer the law with reference to the sale of milled feeds. A method has also been devised for estimating the molasses in certain mixed feeds and a process devised which has enabled a close check on all samples of mixed feeds said to contain molasses.

ANALYSES OF VARIOUS FEEDING STUFFS

In an endeavor to secure information with respect to all kinds of feeding stuffs used in Texas, analyses have been made of water lilies, prairie sunflowers, schrock kafir seed, cienega hay, vega hay, grama grass hay, kafir head stems, and oat screenings.

FERTILIZERS MUST BE AS REPRESENTED

The Chemist of the Experiment Station is by law State Chemist of Texas, and as State Chemist, has control of the fertilizer control law. The inspection and control is exercised over all of the fertilizer sold in the State of Texas, and an annual bulletin is published showing the results of the work. It is gratifying to know that through the efforts of the Chemist in this inspection, the farmers are assured that the fertilizers they buy are up to the guaranteed analysis and that they may safely depend upon them in the application to the soil.

FEED SAMPLES EXAMINED FOR ADULTERATION

The Chemist of the Texas Agricultural Experiment Station during the past year has made examination of 2295 samples of feed for the Feed Control Service, including the determination of protein, fat, crude fiber, water, ash, nitrogen-free extract, together with a physical examination and in some cases a determination of dirt, sand, grit, charcoal, salt, molasses, and other tests to ascertain that the feeds are as represented. These examinations are, in some cases, tedious, but they form the basis of the proper enforcement of the law, which insures the feeders of Texas exact information as to the character of the feed they purchase. The service thus rendered is of inestimable value to the people.

FEEDS ON FARM MUST FIND OUTLET THROUGH WELL BRED ANIMALS

"Live stock on every farm" should be the slogan. Live stock utilizes feeds produced on the farm, such as grass, stalks, and roughages of various kinds and characters, which would otherwise be waste products. Live stock also utilizes surplus feeds which might otherwise be directly put on the market at a loss, and in this manner leaves on the farm the fertilizers resulting from these products, and converts the feeds into compact and readily marketable products, thus reducing transportation expense. Chickens are a notable example, on every farm, of a form of live stock farming which gives big returns because of their utilization of waste and surplus feeds. The same type of live stock farming may be practiced on every farm with other live stock. The question of utilization of these waste and surplus feeds in the most effective way is one of the important lines of work of the animal husbandman. Properly balanced rations with the feeds available on the farm, rather than with feeds that can be purchased on the market, is a question of great importance to every producer of live stock. Results of feeding experiments in which have been included certain basic elements in the ration, show the extent to which feeds of certain classes can be utilized, as well as the manner and extent of their use. Then there is the improvement of the quality and market value of the product, which must be considered. Soft pork causes a dockage on the market of two cents a pound. What makes soft pork, and what feeds and methods of man-

agement are necessary in the production of firm pork? These are questions of interest and important bearing to every producer of pork. They also have a significant economic value. Skill in breeding for obtaining high producing animals, coupled with the correct utilization of feeds, constitutes the major activities of animal industry.

COTTONSEED MEAL CAN BE SUBSTITUTED FOR MEAT SCRAP IN EGG PRODUCTION

Experiments conducted with laying hens, comparing the values of vegetable protein feeds, such as cottonseed meal, with animal protein feeds, such as meat scrap and tankage, for egg production, showed that cottonseed meal can be substituted for meat scrap or tankage, to the extent of 45 per cent. of cottonseed meal in the ration. Tankage proved to be approximately as cheap a source of protein for laying hens as meat scrap.

GRAIN SORGHUMS PRODUCE CHEAPER GAINS THAN CORN FOR FATTENING LAMBS

Experiments in fattening lambs on rations comparing the value of milo, feterita, kafir, and corn, show conclusively that the grain sorghums can be used more profitably than corn for fattening lambs in Western Texas. The lot fattened on a ration including ground milo heads made the most economical gains of any lot—a significant fact inasmuch as it enables the lamb feeder to avoid the expense of threshing the grain. Texas produces annually fifty-nine million bushels of grain sorghum, the surplus of which should be used on the farms where it is produced, for fattening live stock.

FINE-WOOL SHEEP WELL ADAPTED TO TEXAS CONDITIONS

Experiments conducted with sheep, making a comparison of gains made by straight Rambouillet and crossbred lambs on a fattening ration, showed that the smooth-bodied, straight Rambouillet lambs made practically equal gains with any of the crossbred lambs, which, coupled with the fact that the packers will pay top prices for fat, smooth-bodied Rambouillet lambs and the superior adaptability of the fine-wool sheep to range conditions, renders them more desirable for Texas ranch conditions than crossbreds.

PRODUCE INFERTILE EGGS FOR THE MARKET

Experiments with the keeping qualities of infertile eggs showed that the non-fertile eggs will remain in good condition for fifteen days during ordinary Texas summer conditions, indicating the value of removing the cockerel from the laying flock when producing eggs for the market.

SHRINKAGE IN WOOL AND MOHAIR AS AFFECTED BY BREEDING AND ENVIRONMENT

The Thirty-sixth Legislature of Texas made a special appropriation of fifteen thousand dollars for the establishment by the Agricultural

Experiment Station of a wool and mohair scouring and grading plant, for the purpose of making tests of fleeces for the wool and mohair growers of this State, determining the percentage of shrinkage and grade.

The equipment was ordered in 1919, and an up-to-date wool and mohair scouring and grading plant will be in operation at the Main Station just as soon as the machinery and equipment can be put on the grounds and assembled.* With the operation of this wool and mohair scouring and grading plant, a great deal of valuable information will accrue to the producers relative to the influence of breeding and environment on the quality of the fleece.

PEANUTS AND RICE BRAN CAN BE FED TO HOGS WITHOUT PRODUCING SOFT PORK

A swine feeding experiment, using 94 purebred Duroc-Jerseys, half of which had been grazed on peanut field, was conducted, extending over a period of 75 days. The object of this experiment was to determine the feeding value of rice bran fed in various combinations with corn chops and tankage, both as to economic gains, and the quality of the fat on the carcass. The results show that grazing hogs on peanuts

Figure. 6.—Illustrating a method of taking fat samples from the back of a live hog, during feeding experiment for the determination of firmness of the fat.

for six weeks preliminary to the fattening period does not influence materially the hardness of the fat. The lots fed 90 per cent. rice bran and 10 per cent. tankage made the smallest daily gains, but the cost per 100 pounds of gain was less than in any other ration fed. The lots with the self-feeder (free choice) made the largest daily gains, but at the same time showed the greatest cost per 100 pounds of gain. The

*Since the close of the fiscal year and before the publication of this report the wool scouring and grading plant has been installed and samples are being scoured and graded as received.

results further indicated that rice bran can be fed safely with equal parts of corn chops and 10 per cent. of tankage, and in all probability in as high a proportion as 60 per cent. of rice bran, without having the carcasses grade "soft."

Previous work on the influence of peanuts and rice bran on the quality of pork was reported in Bulletin 224. Peanuts when fed to hogs for 40 days produced oily pork. After hogs had been grazing on peanuts for 40 days and then fed a balanced ration of milo chops and cottonseed meal for 30 days, all killed firm.

A mixture of 10 parts of rice bran and 1 part of cottonseed meal, when fed to hogs for 80 days, produced lower gains, and half the hogs in the lot killed oily. By replacing half the rice bran with milo chops in the ration, the hogs made much better gains and all hogs killed firm.

OPPORTUNITY FOR RESEARCH IN DAIRYING

During the year little progress has been made in dairy investigations, due to the fact that it has been impossible to procure a competent research dairyman with the funds available.

Progress has been made in building up the herd and otherwise strengthening the facilities so as to have the best possible condition prevailing when it is possible to secure a competent man.

SILAGE A GOOD SUPPLEMENTAL RATION FOR FATTENING STEERS

A steer feeding experiment covering a period of 120 days, in which two lots of 30 Hereford steers each were fed for the purpose of determining whether or not there would be any advantage in substituting silage in part for cottonseed hulls in a ration composed of cottonseed meal, ground milo, blackstrap molasses, and cottonseed hulls. The results showed that although silage proved to be an advantageous appetizer in the ration, it was not as cheap a feed at the prevailing price of $8.00 per ton as was cottonseed hulls at $9.00 a ton.

Previous tests at this Station have shown that 1⅔ tons of silage are equal in feeding value to 1 ton of cottonseed hulls, on which basis the market value to the feeder, when hulls may be had for $9.00 a ton, is $5.40 a ton for silage. The whole matter, therefore, resolves itself into a question of the relative prices of the two feeds bearing in mind the appetizing value of a small amount of silage added to the ration.

THE INSECT SPECIALIST SAVES MILLIONS OF DOLLARS EACH YEAR FOR THE FARMER

It is estimated that four-fifths of the whole animal kingdom consists of insects. Almost everything needed by man is the natural food of some insect species. In ancient times the locust so ravaged the fields that the human population was reduced to famine and so also would the insects of the present day reduce the human race to poverty but for man's superior intelligence in controlling them. A knowledge of these insects, their life histories, habits, and host plants, affords to man a most effective weapon in preventing excessive depredations.

With the free interchange of commerce over seas and by rail comes an added danger from new insects through the rapidity with which they spread into new territories. Practically every farm crop is menaced by some insect and without a full knowledge of its life-history and habits, the losses would affect not only the pocketbook of the individual, but also that of the State and Nation in an economic way. Then, on the other hand, we have insects beneficial to mankind, as for instance, the honey bee, whose produce adds materially to the wealth of the people. We must know how to control and direct his activities so that he will be more useful by manufacturing honey in a larger quantity and of a better quality. The urgent need for information as to all insect life is obvious.

CALCIUM ARSENATE WILL CONTROL THE BOLL WEEVIL

Experiments conducted at College Station by the Division of Entomology show that the cotton boll weevil may be controlled by dusting the cotton with calcium arsenate. Ten-acre plats were used, and the plats on which calcium arsenate was applied showed a decrease in boll weevil infestation from 44.3 to 14.2 per cent. in a period of two weeks. During the same time the infestation in untreated plats increased from 44.7 to 63.3 per cent. Full information as to the results of this work, including the method of application, the time of application, and so forth, are given in Circular No. 29, entitled "Dusting Cotton for the Control of the Boll Weevil."

COWPEA WEEVIL A SERIOUS PEST IN TEXAS

The cowpea weevil is a serious pest in cowpea seed in Texas, and the importance of the cowpea as a legume crop in this State has made necessary a study of the life-history of the weevil, and methods of its control. This work has shown that the proper harvesting and storing of the cowpea will result in a reduction of from 50 to 90 per cent. of the infestation. The weevil is destroyed in all stages by a temperature of 146 degrees Fahrenheit for a period of fifteen minutes, and is also destroyed by fumigation with carbon bi-sulphide at the rate of four pounds for each 1000 cubic feet of space with a 24-hour exposure. The results of this work, judiciously applied, should result in the practical control of this pest of one of our most important crops. Full details of the results are given in Bulletin No. 256, entitled "The Cowpea Weevil."

LIME-SULPHUR PRODUCTS CONTROL SCALE INSECTS ON PEACH TREES

Tests of various commercial sulphur products as a control for the San Jose scale were made by the Division of Entomology, in cooperation with the Extension Service of the College, using Sherwin-Williams dry lime-sulphur, Niagara soluble sulphur, and Grasselli liquid lime-sulphur. The results obtained during the year show that all three materials will give excellent control under the conditions provided in this experiment. Many trees with scale to such an extent, at the time of spraying (February 24) that they were either dying or would be dead

within a year or two, were found later to be practically free from scale, and in excellent condition on September 1. Experiments will be repeated on a larger scale, testing a larger number of materials, during the coming year. A preliminary report of this experiment, giving the results secured, is made in Circular No. 24.

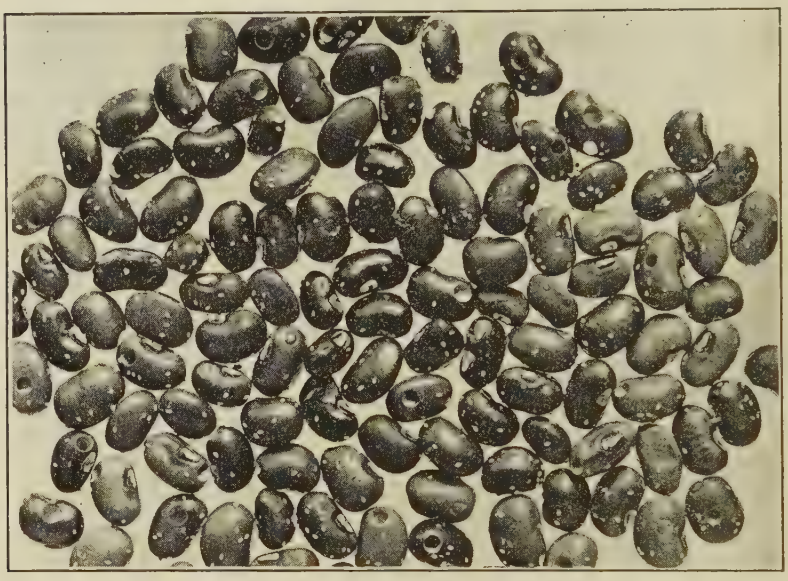

Figure 7. Cowpeas showing cowpea weevil infestation.

SWEET POTATO WEEVIL A MENACE TO COMMERCIAL PRODUCTION OF SWEET POTATOES IN TEXAS

Sweet potato growers of this State each year experience a loss of approximately a million and a half bushels of potatoes due to the ravages of the sweet potato weevil. Experiments conducted with this insect show that these losses can be reduced greatly by the observance of certain cultural practices, such as rotation or the planting of potatoes in clean, uninfested land each year, and the careful use of clean or uninfested slips for planting the potatoes. A bulletin giving the results of this work is now being prepared for publication, and will be available in the near future.

THE COTTON OR MELON LOUSE

The cotton or melon louse is a serious insect pest of cotton and melons throughout the South. It will also live on a large number of other host plants, and is found widely distributed over the world. Studies have been made by the Division of Entomology during the past year which have developed information as to the life-history of this insect and its host plants. The work thus far has indicated that the melon louse can possibly be controlled by natural factors, that is, certain parasites and predacious insects which prey upon the louse. The results of

the life-history and host plants investigations are shown in Bulletin No. 257 on the Melon Louse. The work is being continued, in the hope of securing better methods of control.

PECAN CASE-BEARER SERIOUS MENACE TO NUT CROP

The pecan case-bearer is responsible for much of the irregularity of the nut crop in Texas. Investigations have been conducted of the life-history and extent of infestation of this insect in Texas, with special reference to the working out of control measures. Spraying experiments, using 3 pounds of arsenate of lead to 50 gallons of water, during the past year have indicated that it will be possible to control this insect by spraying. The experiment was conducted on twenty-five large pecan trees, and the use of the arsenate of lead spray gave 89 per cent. control of the insect during the year. It was found best to spray the trees when the nuts are about the size of a small bean or pea.

This work is conducted in cooperation with the School of Agriculture of the College, by the Department of Entomology of the College, under the memorandum of understanding between the Station and the School of Agriculture for cooperative investigational work.

DISTRIBUTION OF TESTED ITALIAN QUEEN BEES

Experimental Apiary No. 3, located near San Antonio, and put into operation on April 15, 1920, has produced 181 Texas-bred tested Italian queens, which have been distributed to Texas beekeepers. The demand for queens, however, has been so great that 449 applications remained unfilled at the end of the year. It is planned to enlarge this yard until a capacity of 1000 queens is reached for the coming year.

In addition to the distribution of queen bees, notes have been taken on the relationship between honey-flow and queen breeding, the inherited characters of queens, and methods of producing queen cells.

Apiary No. 1, located at College Station, and Apiary No. 2, near Dilley, Texas, provide suitable conditions for the study of the honey producer's problems, including a systematic study of the honey-bee family; the honey plants adapted to the various sections of the State, and economic methods of production.

Through the efforts of the Texas Honey Producers' Association and of the Texas Beekeepers' Association, the State Legislature provided a special appropriation for the establishment of experimental apiaries, for the study of the many perplexing problems confronting the beekeeping industry of the State. Under the provisions of this appropriation, the Station has established experimental apiaries at College Station, Dilley, and San Antonio.

Texas is in the foremost rank as a honey-producing state, despite the fact that the industry is not yet fully developed, either in territory or in the general knowledge and use of best methods of beekeeping.

FOULBROOD INFESTATION GREATLY REDUCED

American foulbrood of honey bees has in the past made serious inroads on the bee colonies of this State. The losses became so great as to discourage beekeepers and threaten the industry. Accordingly, the

foulbrood eradication law was passed by the Legislature of Texas, providing for the inspection of bee yards and colonies and the treatment or destruction of diseased colonies. This law named the Entomologist of the Experiment Station as State Entomologist and charged the Director of the Station with the enforcement of the provisions of the law, and this work is done through the Division of Entomology. The work has met the hearty support of the beekeepers, and during the year just passed the infestation has been so greatly reduced that it is believed that with appropriations to vigorously push this work, American foulbrood can be entirely eradicated from this State. During the year, 25,676 colonies of bees were inspected, of which less than 4 per cent. were found to be infested with foulbrood.

FIELD BURNING OF SULPHUR TO CONTROL BOLL WEEVIL

Tests were conducted to determine the efficiency of burning sulphur in the field at night for the control of the cotton boll weevil. The results of this test showed no benefits, since the weevil infestation in the plats where sulphur was burned increased as rapidly as in the plats where no sulphur was burned.

SUCCESSFUL CROP PRODUCTION MADE POSSIBLE BY RESEARCH

In Texas there are 435,666 farms interested in the production of farm crops for sale directly or through live stock. Successful production of farm crops does not mean quantity production alone, but rather economical production. It is of importance to the individual grower to increase his acre production without disproportionately increasing the costs, as this procedure automatically decreases the cost of production per unit, and gives the farmer larger returns for his effort. To do this, the producer must of necessity use highly productive crop strains and methods of growing that will yield him the maximum net returns. Research work in agronomy develops information on the surest and easiest methods of getting the largest net returns from the crops used. Research in agronomy involves not only the improvement of various farm crop strains, but also develops information which will enable the farmer himself to improve these crop strains. Research in agronomy is developing better tillage methods by the study of the relation of the tillage of the land to the crop turn-out. Texas comprises a territory as large as the great corn belt of the Middle West, with a soil and climate unexcelled, which, if intelligently farmed to the right crops by the proper tillage methods, will attract and support a population as dense and as prosperous as any farming section in the world. The agronomist in providing the optimum condition for the fruiting of the plant by the use of better strains, better tillage, or giving permanency to the fertility of the land, contributes a practical means of combating the various insects and plant diseases which destroy the farmer's crop.

SPUR FETERITA DEVELOPED AND DISTRIBUTED TO FARMERS

Spur feterita is the name of a new and distinct variety of grain sorghum developed by the breeding work of the Texas Agricultural Experiment Station at Substation No. 7, Spur, from the unimproved feterita as introduced from Africa. It is a distinct variety with a thicker stalk than milo, kafir, or the unimproved feterita. It is not so tall as the unimproved feterita, has a more compact and better filled seed head, and produces a higher percentage of grain to the head. It requires a slightly longer growing period than milo or the unimproved feterita, but has produced, in a five-year period at Spur, an average of 7.89 bushels to the acre more than unimproved feterita. Spur feterita is now pretty generally in the hands of West Texas farmers, and is recognized as being superior in grain production, as well as an excellent variety for forage purposes.

CORN ORDINARILY PLANTED TOO THIN FOR LARGEST YIELDS

Experiments in corn production during the year have shown that corn planted at the rate of 9680 stalks to the acre gave a yield of 71 bushels to the acre, while corn planted at the rate of 2420 stalks to the acre gave a yield of 21 bushels to the acre, with intermediate rates ranging between the two extremes in yield. These results are in line with results obtained from seven successive years' work at College Station. It should be borne in mind, however, that thickly planted corn will not produce high yields on poor land. With a system of crop rotation to maintain and build up fertility and the use of good farming methods, however, thicker planting of corn in Texas will materially increase the acre yield.

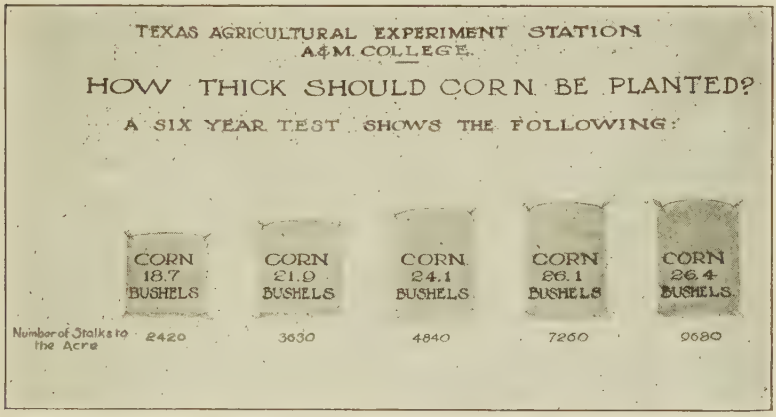

Figure 8.—Results of average of six years work in planting corn at different seeding rates. Division of Agronomy.

CROSS-POLLINATION LOW IN GRAIN SORGHUMS

Studies of the percentage of cross-pollination in milo in the field have shown that individual plants entirely surrounded by other plants have been cross-fertilized to the extent of 6 per cent. This would

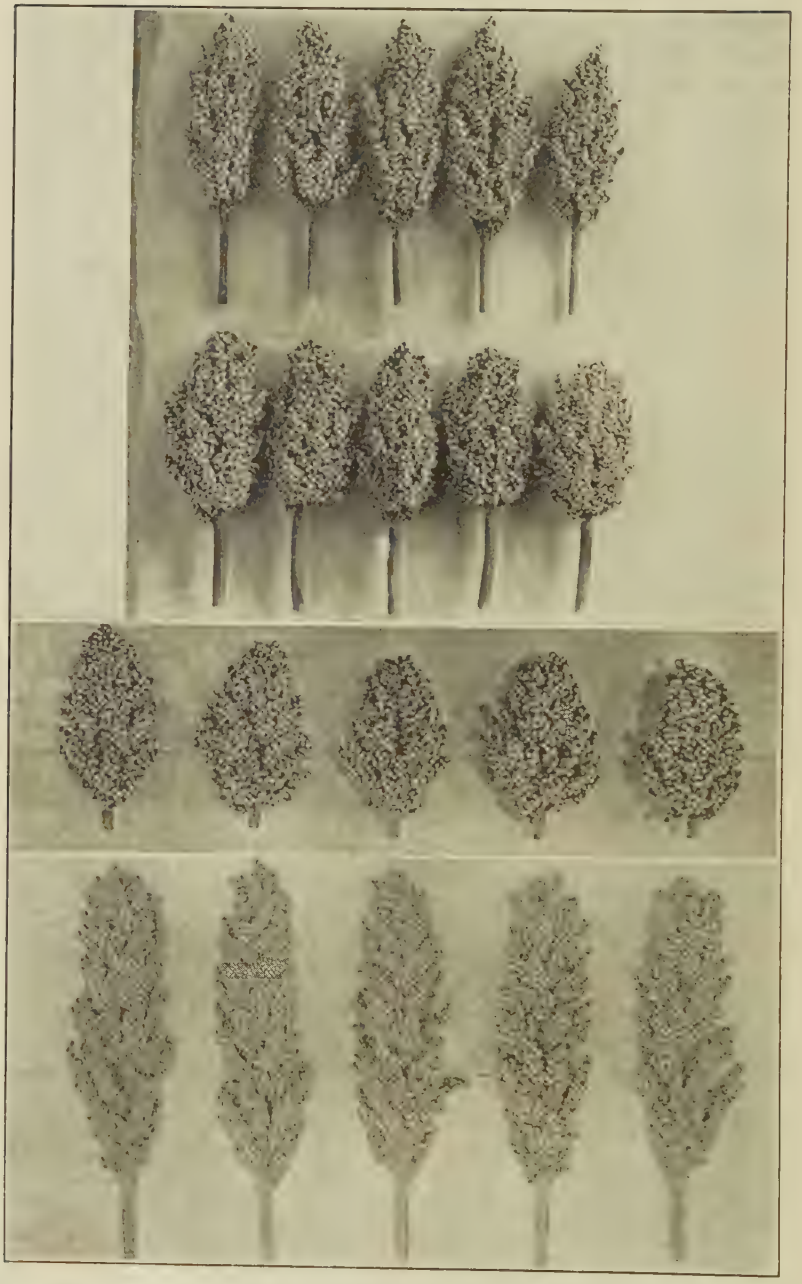

Figure 9.—The three principal types of grain sorghum grown in Texas.
Top: Spur feterita, a new variety established by the Station.
Center: Dwarf milo which has been materially improved by the Station.
Bottom: Blackhul kafir, a high-yielding strain of which has been produced for distribution to farmers.

indicate that in growing seed fields of milo or other grain sorghums a minimum amount of care exercised in planting pure seed on clean land and in properly isolating the field will enable the production of uniformly pure seed of grain sorghums. Unquestionably Texas, in the production of 59,000,000 bushels of grain sorghum annually, takes a loss of thousands of dollars in the planting of mongrel or mixed seed instead of some pure and well known high-yielding strains.

GRAIN SORGHUMS EASILY PURIFIED

Recent investigations have developed the fact that purity and consequent uniformity of characters in kafir can be obtained in the second generation, and that subsequent crops will show continued purity and uniformity with respect to individual characters. This means that high-yielding and superior strains may be established with certainty—a fact of immense practical value to Texas, inasmuch as this State produces one-half of the entire grain sorghum crop of the United States. Bulletin No. 279 gives full details of this work.

BETTER YIELDING KAFIRS

The breeding work with standard blackhul kafir being done at Substation No. 8, Lubbock, has developed a pure-line kafir known as Black-

Figure 10.—Pure-line Blackhul Kafir 153, a product of breeding work by the Station. Note the high degree of uniformity shown in this field.

hul Kafir 153, which has constantly been the highest yielding strain grown for three generations. Since it has been shown by previous work that any character, such as high production, can be established or fixed in the second generation, this kafir should continue to be a high-yielding strain as long as it is kept free from contamination by crossing or

mixing with other strains. Fourteen hundred pounds of seed have been grown for distribution through the county demonstration agents of the Extension Service of the College, to farmers for increasing the supply of seed for use by farmers another year.

COWPEAS SHOULD BE PLANTED IN CORN AT THE RIGHT TIME

Throughout most of the corn-growing region of Texas, cowpeas can be planted in the corn for seed and for soil improvement. Experiments conducted at the Main Station for determining the effect on the corn of planting cowpeas between the rows, have shown that where the cowpeas were planted at the same time the corn was planted, the yield of corn was reduced 16½ bushels to the acre, or more than half, whereas cowpeas planted in corn when the corn was beginning to tassel, showed no reduction in the corn yield. The cowpea is a very desirable crop to plant in corn fields, but should not be planted during the early stages of the growth of the corn. A bulletin giving detail results of this work is in preparation for publication.

CLEAN TILLAGE AN IMPORTANT FACTOR IN CROP PRODUCTION

Clean tillage is perhaps a more important factor in crop production in Texas than it is in some other states for the reason that in much of the State the moisture is the limiting factor. With the development of the principles of dry-farming, there has sprung up a tendency to disregard the necessity for eliminating weeds and grass during the process of cultivation. Cotton cultivation experiments at Substation No. 12, Chillicothe, have shown that moisture conservation is most important, and that weeds and grass probably remove more soil moisture than hard or baked soil. In fact, good crops of cotton have been produced in these experiments by removing weeds by methods other than those which make a soil mulch. Cultivation which kills weeds and grass, and at the same time produces a mulch, is most effective.

CROSS-CULTIVATION SAVES HOEING

During the period of high-priced farm labor, the planting of both cotton and corn in check-rows in experiment work has resulted in a great labor saving on account of the readiness with which the rows could be cultivated in any direction. In both cotton and corn, the stand can be satisfactorily adjusted by leaving a sufficient number of stalks in the hill to equal the seeding rate desired.

A NEW SOIL IMPROVEMENT CROP THAT IS RESISTANT TO ROOT ROT

Guar, an upright-growing legume introduced from India, has been found, at Substation No. 5, Temple, to be entirely unaffected by root rot. This discovery makes available to the farmer a legume crop of great value as a soil improver, and without the danger of being a host plant for the root rot. Guar may be used for either forage or green manure, and when used in the latter way has a very beneficial effect upon the land. Guar is said to have on its roots the largest nitrogen-

fixing nodules of any legume known. Seed for distribution to farmers is being produced at Substation No. 5, Temple, and at Substation No. 8, Lubbock.

Figure 11.—Guar, a root rot resistant legume, is shown on the right; illustrating its resistance as compared to the resistance of the cotton shown on the left.

SULPHATE OF AMMONIA A GOOD FERTILIZER FOR RICE

Experiments to determine why rice does not respond readily to the ordinary fertilizers have shown that possibly this is because the wrong nitrogen carrier is used. This is particularly the case with some of the more soluble forms of nitrogen. In the experiments carried out at Substation No. 4, Beaumont, rice has responded readily to sulphate of ammonia, while cottonseed meal comes second in order as a source of nitrogen. Valuable and interesting information has been secured in this connection, which shows that the time and method of applying the fertilizer is possibly of much greater importance than the exact analysis or amount of the fertilizer. One of the chief reasons for the heavy use of water on young rice has been for weed control. It is now apparent that weed infested fields when fertilized, or fields where fertilizer is applied early in the season, will usually be very weedy throughout the season, and the weeds rather than the rice will get the benefit of the added fertilizer, the result being a decrease in the crop as compared to no fertilizer. On the other hand, where the fields are carefully cleaned up before planting the rice and where seeding is done slightly late and where the fertilizer is applied somewhat late, so that the rice is already well established, the stimulus and growth produced by the fertilizer is directly felt on the rice, rather than on the weeds, and the result is a decidedly greater increase in the yield of rice. Herein is contained information of the utmost importance to the rice grower, and it is a pleasure to note these results are being used by the farmers.

FINDING BETTER PRODUCING ALFALFA

Certain sections of Texas are well adapted to the production of alfalfa. It has been observed that individual plants of alfalfa in the field are outstandingly good producers of hay, just as certain individual cows are high producers of milk. At Substation No. 7, Spur, 17,000 seedling alfalfa plants, spaced uniformly one foot apart each way, are being grown for observation as to their relative individual growth and suitability to the conditions there. A certain number of outstandingly good producers have been selected from the nursery, and these are being planted in rows by means of cuttings for a further comparison. When the two or three best producing strains are isolated, they will be separately increased for distribution to farmers, with the view to establishing seed fields for wide and general use of these better strains of alfalfa where they are adapted.

Figure 12.—Rice plats, illustrating method of conduct of fertilizer and variety tests with rice. Substation No. 4, Beaumont.

SWEET CLOVER AN EXCELLENT SOIL IMPROVER FOR THE SMALL GRAIN GROWER

Sweet clover has been tested at practically every substation, and while it has been found to be a successful crop in nearly every instance, the results secured at Substation No. 6, Denton, have shown the special suitability of sweet clover to the North Texas wheat belt, and to the needs of the exclusive small grain farmer. Sweet clover has been successfully planted in wheat or oats in January, and has been found well established at the time of cutting the small grain. The white-flowered biennial type will then live over into the next summer, thus providing at least two hay crops, or almost a year of good pasture. At the end of its growing period it is plowed under with very beneficial effects on the yield of the succeeding crop. The use of treated or scarified sweet

clover seed has been found safest, as the scarifying process cuts through the hard seed-coat and allows prompt germination. As a general rule no artificial inoculation with nitrogen-fixing bacteria is necessary for sweet clover, but on new lands it is well to be sure that inoculation is present.

Figure 13.—Sweet clover is a very profitable crop under Texas conditions, and provides not only good crops of hay and grazing, but is also an important soil improver.
Top: Second year's growth of sweet clover just before first cutting of hay, Substation No. 6, Denton.
Bottom: Harvesting sweet clover, Substation No. 8, Lubbock.

MORE WHEAT TO THE ACRE

Wheat farmers of North Central Texas are showing an increased interest in the results secured from experiments with wheat at Substation No. 6, Denton. These experiments have shown that to obtain maximum yields some attention must be paid to rotation and soil im-

provement. It has been shown that to produce an abundant crop of wheat, at least 60 days of clean summer fallow is necessary just before planting. The plowing of the land 60 days before planting, without any intervening tillage to remove weed growth, conserve moisture and pulverize the soil, will not produce maximum yields. In other words, early preparation of the seedbed for wheat must be followed by a sufficient amount of cultivation to keep the land free from weeds, to conserve moisture, and to promote favorable conditions for making plant food available to the crop, for the most profitable yield. It emphasizes the value of farming the land as compared to the early-day methods of sowing and reaping.

Figure 14.—Mediterranean wheat on land where rotation of crops is practiced. Substation No. 6, Denton.

KANRED WHEAT BEST FOR NORTHWEST TEXAS

Experiments conducted at Substation No. 12, Chillicothe, have shown that the Kanred wheat, a new variety, originated at the Kansas Agricultural Experiment Station, is superior to other hard red winter wheats in Northwest Texas. Tests at Substation No. 6, Denton, and Substation No. 5, Temple, show that Kanred is the best hard red winter wheat for these sections. The suitability of this variety to Northwest Texas and the results secured at Denton and Temple indicate that the hard wheat belt can be extended southward and eastward.

INCREASING THE YIELD OF OATS

Texas is ordinarily regarded as a winter oat producing district, but observation and statistical information tend to show that the greater part of the crop is spring-planted, seeding being done in January and February. The three things having most to do with the yield of oats appear to be winter resistance, drouth resistance, and rust resistance. It can be seen, therefore, that agronomic methods of testing a variety repeatedly through a series of years to determine its yield are necessary

to know the suitability of different varieties and for the production of varieties resistant to rust and drouth. Tests at College Station and at Substation No. 5, Temple, and Substation No. 6, Denton, and Substation No. 12, Chillicothe, have resulted in the growing of pedigreed pure-line strains on an increasing scale, for distribution to farmers.

In tests at Substation No. 6, Denton, certain strains of Appler, Fulgham, and Ferguson 71 oats have been shown to be high producers, and efforts are now being made to obtain from these a number of pedigreed pure-line strains that are relatively tall and uniformly heavy producers of grain. Rust resistance in oats has been found to be lacking in a very great many of the so-called rust resistant varieties.

Figure 15.—Illustrating the difference in earliness and productiveness of different strains of oats. It is necessary that the characteristics of the different varieties and strains of oats be accurately determined.

OBTAINING HIGH PRODUCTION IN PEANUTS

The peanut is becoming an important crop in Texas. The Spanish variety is almost exclusively grown, and is perhaps better adapted to Texas conditions than any other. The Spanish peanut, however, as grown at the present time, contains individual plants which have a wide range in type, general appearance, yield, quality, and uniformity of ripening. Substation No. 11, Nacogdoches, has tested a large number of Spanish peanut families, originated from single plant selections, and has now established certain improved strains of this crop which possess high-producing qualities. Particular attention has been given to yield and oil content. The better yielding strains are being rapidly increased for distribution to farmers who can be depended upon to grow them as pedigreed seed for wider distribution in the peanut growing sections.

Figure 16.—Proper method of shocking peanuts in the field in East Texas.

PURITY AND GERMINATION IN PLANTING SEEDS

During the year the Division of Agronomy has operated a seed laboratory, in cooperation with the Seed Laboratory of the United States Department of Agriculture, for the testing of purity and germination of planting seeds for farmers. A total of 1646 seed samples was handled. This work has been of great service to the farmers, as it showed the germinating power and the purity of the seed in question, and has assisted the farmers in procuring and planting seed of good germinating qualities and free from impurities.

PREVENTABLE PLANT DISEASES CAUSE HEAVY ANNUAL LOSSES

Plant diseases take their annual toll by causing losses amounting to millions of dollars. In Texas it is estimated that the annual losses amount to more than seventy-five millions of dollars. Much of this is preventable, but to accomplish prevention there must be available a fund of information as to the cause, life-history, and duration of plant diseases in order that remedies may be prescribed. Plant life furnishes to man a large portion of his food supply, and, therefore, man must combat plant diseases in an intelligent manner, both for his individual gain and for economic reasons. The cotton root rot disease alone causes staggering annual losses in Texas. The losses to the cotton growers of the State from this single disease alone in any one year would be many times sufficient to pay the cost

of securing the most complete information, through agricultural research, as to the nature of the disease and how to control it.

WATERMELON WILT DUE TO FUNGUS DISEASE

Watermelon wilt is a fungus disease found to be induced by any one of three distinct species of *fusaria,* two of which are new to science. These three species do not attack the cashaw, squash, cucumber, cantaloupe, blackeyed pea, okra, tomato, cabbage, or cotton, and hence the watermelon wilt is not transmissible through these plants as hosts. The watermelon is the only known host plant at the present time. These fusaria are soil organisms capable of living from year to year on the organic matter in the soil. A three-year rotation of crops has materially reduced the disease, and it seems certain that with a judicious cropping of the land, losses from watermelon wilt will be reduced to a negligible quantity. Moreover, since the watermelon wilt does not attack the several crops mentioned, the matter of rotation for the control of wilt is simplified. Bulletin No. 260 gives full information on the experiments with watermelon wilt.

ANTHRACNOSE DISEASE OF WATERMELONS IS PREVENTABLE

Anthracnose is an important disease affecting watermelons. It attacks the foliage and the fruit about the time the fruit sets. The disease is of economic importance only during wet years. The greatest damage is occasioned in transit, resulting in the appearance of large decayed spots in the rind, and consequent loss of the melon. The rapidity with which this organism works on the melon frequently causes heavy losses on shipments which appear to be in good condition when loaded. Spraying when blooms appear with 3-8-50 Bordeaux Mixture has given excellent results in the control of this disease.

STEM-END ROT OF WATERMELONS BEING STUDIED

Studies have been made on the stem-end rot of watermelons, caused by species of *Diplodia.* This disease is of great economic importance as a transit trouble, although it causes very little damage in the field. Cross-inoculation of this organism with *Diplodia tubericola Taub.* (Java Black Rot) isolated from the sweet potato, seems to indicate that they are one and the same. This being the case, neither crop should follow the other if it is desired to evade this disease.

BLOSSOM-END ROT OF WATERMELONS IMPORTANT AND SERIOUS PROBLEM

The study of the blossom-end rot of watermelons has been attended with little or no progress, because of the need of a field laboratory and facilities for culture work on the grounds. It is impossible to study blossom-end rot by shipping the affected melons to the Main Station laboratory, as the shipping so short a distance as from Prairie View to College Station has been found to cause the melons to be entirely overrun by a varied mycological flora, obliterating the primary cause.

COTTON ROOT ROT CAUSES HEAVY ANNUAL LOSSES TO FARMERS

The disease known as cotton root rot, or Texas root rot, is localized mainly in the black lands. It is due to a sterile organism *Ozonium omniverum,* which propagates itself in the soil by means of sterile mycelium, which live over on the roots of any plants that may survive the winter. Such root crops as sweet potatoes, sugar beets, or any other fleshy root, are especially favorable as hosts to carry over winter the fungus of this disease. The range of host plants of this disease has been studied, and it is definitely known that certain fruit trees, such as apple, pear, grape, fig, mulberry, and so forth; cowpeas, okra, sweet potato, and numerous other field crops, as well as certain weeds, such as cockle burr and wild morning glory, are hosts of cotton root rot, and act as carriers of the causal fungus. This information emphasizes the importance of clean tillage and rotation of crops for combating the disease. Exact information as to the relation between soil temperature and soil moisture and the root rot fungus has not been fully worked out, but on account of the serious and extensive losses suffered by the cotton farmers of Texas on account of this disease, it must be vigorously studied, with the view to ascertaining the precise nature of the fungus throughout its development and possible means of control.

"SUGAR-THROUGH," EDIBLE GOURD RESISTANT TO SQUASH AND CASHAW WILT

In the study of wilts in the squash, cashaw and gourds, a certain variety of gourd, known as the "Sugar-Through," was found to be 100 per cent. resistant to wilt. This gourd has also been found to be edible, being almost indistinguishable from the pumpkin. In fact, many people consider it superior. The resistance of this edible gourd to wilt should prove of great value to farmers, truck growers, and even to cattlemen who find land infested with the wilt disease.

PINK ROOT OF ONIONS IS A FUNGUS DISEASE, AND CAN BE CONTROLLED

Pink root of onions has been a very serious disease in parts of the onion growing region, along the Rio Grande Valley. Studies have been made to determine the cause of the trouble and methods of control. It has been found that this disease attacks all kinds of onions and garlic, but does not attack any other plants belonging to the Liliaceae family. Since the work has been under way the pink root disease has been found on onions in Louisiana, California, New York, Michigan, Iowa, and the Bermuda Islands. The organism is carried with the soil in the seedbed, and to the main field with the sets used for transplanting the main crop. Treating the infected sets has not proved effective, but sterilizing the seedbed either by use of steam or formaldehyde is an effective way of preventing the spread of the disease in the sets. These healthy sets, if transplanted on new land, will result in a crop free from pink root losses. Fields infested with pink root should not be planted to onions unless it is absolutely necessary, in which event applications of fertilizer will tend to stimulate more rapid growth and retard advance of the disease. The best measure of precaution, however, is to provide a seedbed free from the disease and a field also free from the infesta-

tion. This can be done either by taking in new land or rotating the onion fields sufficiently to clean the land before it is planted to onions again. Bulletin No. 273 gives full information as to the results of the pink root investigations.

Figure 17.—Pink root disease of the onion. Note the dying of the roots as the plant develops. This dying of the roots prevents the plant from securing the proper plant foods for its best development.

SOIL TEMPERATURE HAS VITAL RELATION TO DEVELOPMENT OF PLANT DISEASES

A thorough-going and exhaustive study of soil temperatures in connection with plant disease development, both in the open air and the soil, at varying depths, is being made. These data are being collected from three different points, namely: Prairie View, Troup, and Temple. These studies will be duplicated in soil temperature tanks in the greenhouse at the Main Station, so that there will be available complete data as to the soil's temperature from time to time at different depths, and its association with plant disease epidemics.

BLACK-MOLD OF EAR CORN IS CAUSED BY FUNGUS

Black-mold of ear corn is a disease, more or less serious in the fields of this State, particularly in dry seasons. The fungus is generally transmitted directly to the ear when the grains are in the milky stage, by the ear worm, and other insects which may cause injury to the developing ear.

The same fungus causes a very serious disease in blackeyed peas, both to the plants and to the peas in the field. It further causes a serious rot in the fruit of the squash; a storage in transit disease in onions,

as well as a trouble with peanuts in transit which have been improperly harvested or cured. The same mold attacks grain sorghums. Bulletin No. 270 gives complete results of the studies of black-mold of ear corn.

STORAGE DISEASES OF THE SWEET POTATO

Storage diseases of the sweet potato can be reduced by properly curing the potatoes. Studies in the storage and storage diseases of the sweet potato have shown that the diseases of the field are intimately connected with the storage problem. Some of the more important diseases determined as having effect on the storage of potatoes are black rot and soft rot. Black rot is a field and storage trouble, while the soft rot is a storage trouble only. For the proper storage of sweet potatoes precautions should be taken to grow the crop so as to have it free from disease and the roots free from injury and possible disease infection. The matter of storage and storage houses has been fully reported upon in Bulletin No. 250 issued by this Station.

TOMATO FOLIAGE DISEASES CAN BE CONTROLLED BY SPRAYING

Experiments carried on at Substation No. 2, Troup, with the two principal foliage diseases of the tomato in East Texas, early blight and leaf firing, have indicated that these diseases can be controlled by spraying with 4-4-50 Bordeaux Mixture, without apparently delaying the earliness of ripening. Experiments with this and other tomato diseases are being continued with the view to working out complete and satisfactory methods of control.

PLANT DISEASE SURVEY

Plant disease survey work is being done by the Division of Plant Pathology and Physiology in cooperation with the United States Department of Agriculture, in an endeavor to accumulate and catalogue data as to the occurrence of different plant diseases in various parts of Texas from year to year, so that estimates can be made of the losses, and possibly predictions made as to the occurrence of epidemics in certain localities.

PURE FEEDING STUFFS FOR FARMERS AND STOCKMEN

Under State law, the Director of the Texas Agricultural Experiment Station is charged with the enforcement of the provision of the Pure Feed Law. This law requires the appropriate naming and tagging of all concentrated commercial feeding stuffs sold in the State, prohibits adulteration, authorizes the Director to establish and maintain standards for the various feed products and provides penalties for violations of the law. The work of enforcing the feed law is done by the Director through the Division of Feed Control Service, the entire expenses of which are paid from fees collected from the sale of inspection tax tags. In addition to publishing lists of the manufacturers and sellers of various feeding stuffs in the State, to-

gether with information as to violations of the law, this Division conducts appropriate investigations as to the composition and relative values of Texas feed products, in order to allow increased efficiency and a better enforcement of the law. The Director has been enabled to secure increased efficiency in the enforcement of the feed law by virtue of cooperation with the United States Department of Agriculture which allows the prosecution of out-of-the-State manufacturers and shippers of deficient feeds under the Federal Food and Drugs Act of 1906 when such products are shipped into Texas. Without payment of a tax, the consumers are assured of getting exactly what they buy in the way of feeding stuffs.

The standards of cottonseed products, as maintained by the Texas Feed Control Service, provide for products of the highest quality. Cottonseed meal must not contain an excess of crude fiber. The standards for this product in Texas are, by requirement, much higher than the standards for cottonseed meal in other states. The quality of Texas cottonseed products has been recognized not only in this State, but throughout the United States, and instances are on record where large purchasers in Northern and Eastern States have passed up the products of low standard, in order to pay a higher price for the high-standard Texas product.

No other State in the Union has a feed control service which gives more definite and satisfactory information to its people, and it would not seem out of place here to say that no other State is better enforcing its pure feed law for the protection of its farmers and stockmen than Texas.

BELATED FORESTRY TO SALVAGE A PRICELESS RESOURCE

None feel the need of trees so much as those who have no trees. The conversion of the vast Texas prairies into a farming area brought with it the necessity for trees—trees for fuel, trees for shade, trees for fence posts and building timbers, trees for windbreaks, trees for ornament, and trees for every possible useful purpose. It was a great treeless region, and nature, for thousands of years, had not made her usual tests there. The problem was to find trees adapted to the soils and climate and easy of propagation. To realize how necessary this is, one need only travel through the great farming regions of Western Texas to see fine groves of locust and other useful trees growing about each model homestead; but the great majority of homes are not so improved. Forestry research has found many useful trees well adapted and is finding splendid new trees for that region, including the beautiful Chinese elm, and the residents are encouraged to foster the growth of all these, including the hardy mesquite and other native trees. The pity is that forestry did not receive attention earlier in the conquest of West Texas and that the necessary research cannot

be speeded up to the highest possible efficiency so that no farmstead shall remain without ample trees of the best kind for every economic purpose.

In the great natural forest region of Texas, Mother Nature laid into the laps of the settlers a bounteous wealth of the finest pine and hardwood timbers. These forests have been slaughtered without a thought of another crop which nature, unthwarted, might have laid into the lap of the next generation. Natural timber lands have been perverted and attempts made to produce on them crops for which they may be far less well adapted than for lumber trees. Research is necessary to determine proper methods for growing new forests of the most useful timbers on these potential forest lands and whether tree crops, though they require long years to mature, are the crops most profitable for them to grow.

INTRODUCTION AND TESTING OF FOREST AND SHADE TREES

The introduction, testing, and propagation of forest and shade trees in the different regions of Texas has been conducted through twelve of the substations located in different agricultural regions. The work at

Figure 18.—Two-year-old growth of Chinese elm trees at Substation No. 8, Lubbock. This elm is a new introduction from China which is proving to be admirably adapted to Texas conditions.

the several different points is already beginning to attract favorable attention, even though the trees and shrubs are for the most part small. The windbreak plantings at Substation No. 8, Lubbock, particularly, are attractive, and will provide from year to year much valuable information on the growth and adaptability of trees for all economic purposes. The Chinese elm, a recent importation from China, planted

in 1919 at Lubbock, has made a most wonderful growth, and seems to be perfectly well adapted to the South Plains country.

DISTRIBUTION OF SHADE AND ORNAMENTAL TREES

Shade and ornamental stock has been grown in the nursery during the year, and 9500 trees have been distributed and planted at farm homes, rural and city schools, parks, and other places where their growth and behavior might be observed from year to year, and supplemental data gathered as to their suitability for the particular section. It is estimated that 25,000 trees will be available during the coming year.

TEXAS MUST LEAD IN THE DEVELOPMENT OF BETTER COTTON

Contrast the cotton plant of today with that of ten, twenty, thirty, and fifty years ago, and it will be seen that the most remarkable advances have been made by breeding. Changing conditions have brought a strong demand for better staple and for better fruiting varieties of cotton; for varieties suited to soil and climatic variations in the different agricultural regions, and for varieties that evade the ravages of insects and diseases. The cotton of today is a highly bred crop, and without this breeding the quality and production would be low under existing conditions. Much has been accomplished by the research studies of the cotton breeder in the discovery of facts and principles necessary for the improvement of the crop. It is desired to combine in one variety of cotton many desirable characters, and we now know that desirable and undesirable characters are associated to a degree, and yet the cotton breeders of the world today have much evidence that a full understanding of this association, or linkage, of characters will enable the intelligent breeder to re-combine a number of desirable characters in a single variety. Until these fundamental principles of breeding are fully worked out, the improvement of the cotton plant by the selection of superior individuals will remain the sole means of advancement. Texas, normally producing four million bales of cotton, or one-third of the total cotton crop of the United States, can, from the standpoint of economy and efficiency, take no other course than to vigorously pursue the research studies looking toward the discovery of knowledge that will enable her cotton growers to produce cottons of superior staple, higher production, and greater resistance to diseases and insects.

TEST OF VARIETIES SHOWS SUPERIORITY OF CERTAIN STRAINS

Extensive tests of varieties of cotton at the Main Station and at all the substations, involving more than 100 varieties, obtained from all parts of the United States where cotton is grown, and from foreign countries, have shown that the Texas cottons, such as Mebane, Lone

Star, Truitt, Bennett, Rowden, Belton, Acala, Kasch, and other varieties of similar type, are better suited for Texas than any of the varieties commonly grown east of the Mississippi River. This work, in fact, has been in part responsible for the elimination of a large number of varieties not suited to Texas conditions. This fact is brought out very forcibly in a paper published by the United States Department of Agriculture, in which the statement is made that Texas in eliminating all but a few standard, good-producing varieties, has made material advances over other States where numerous varieties are planted.

How Long Does it Take to Obtain Purity and Uniformity in Cotton?

Experiments conducted for the purpose of obtaining pure and uniform strains of cotton for use as breeding stock, have indicated that five years of intensive inbreeding have not accomplished absolute purity. This is a significant fact, inasmuch as purity and uniformity in the varieties of cotton are highly desirable, and it is now known that the process requires a considerable period of time and the exercise and use of intelligent methods. With an annual production of around four million bales of cotton, Texas assumes a tremendous economic loss in the lack of more general use of pure, uniform, and high-producing varieties.

Establishing High Oil-Producing Strains of Cotton

It has been found that within a variety different plants of cotton show seed containing varying percentages of oil, and that high and low oil-producing strains can readily be established, by the ordinary methods of selection and inbreeding. High and low oil strains have been developed, but it has been found that high oil strains give a low turnout of lint. The increase in value due to the higher oil has not been sufficient, in the strains thus far established, to offset the low turnout of lint. High oil cottons have been found to have large seeds. The strains are not considered of commercial value at this time, but are being used for the purpose of studying the relation between oil production and other characters, and may result in pointing the way to better money-producing strains.

Comparative Lengths of Staple in Different Varieties of Cotton

Measurements of length of staple have been taken for the principal varieties of cotton grown in the State, by stapling the cotton from each variety at every substation where cotton was grown. In this manner accurate and, therefore, reliable, information was secured as to the average staple, or length of the different varieties of cotton, as grown under varying soil and climatic conditions. These staples have also been evaluated, thus setting forth the desirability of the best staple. Of course, the extremely long staple varieties, commanding the higher price, are as a rule less productive in pounds to the acre and in lint percentage, and hence the longest staple cotton is not necessarily the

best money producer. Bulletin No. 266, entitled "The Staple of Texas Cotton," gives full information as to the staple of the leading Texas varieties.

COTTON BREEDING FOR INFORMATION

Cotton breeding work, leading to the development of new information as to how to produce new and improved strains of cotton, has shown:

That the cross-breeding of cotton should not be attempted by laymen, as hybrids split up in the second generation in certain definite proportions, explained in Mendel's law, and unless the breeder is familiar with this fact he will attain no certain results.

That the opportunities offered by cross-breeding to the experienced breeder are those of re-combining certain desirable characters in a strain of cotton. These studies have indicated the linkage, or association, of certain characters, which, in a large measure, precludes the possibility of obtaining desirable combinations, and it is the aim of these studies to account for these associations of characters, and with a better understanding possibly devise methods of re-combining the desirable ones. Examples of the close association of characters are: length of staple and small bolls; length of staple and low ginning percentage; length of staple and late maturity, and other similar important and fundamental characters.

SOIL SURVEYS CLASSIFY AGRICULTURAL AND NON-AGRICULTURAL LAND

The soil survey provides a detailed inventory of the soil resources and as it classifies the agricultural and non-agricultural land, it is highly valuable to the individual farmer, to investors in farm property, and for the appraisement of land values for various purposes, for the location of good roads, for making public health and sanitary surveys, for the indication of deposits of gravel, sand, shale, tile, and pottery clays, and other valuable natural resources of the land. The soil survey is also fundamentally important and valuable to the experiment stations in the study of soils and soil management, crop adaptations, and other agricultural problems. It classifies the land which is suitable for forestry purposes, indicates swamp land capable of being reclaimed, the dry land suitable for dry land farming, the arid soils which may be irrigated with profit.

A reconnoissance survey shows large tracts of land of certain soil types, marshes, clay, and so forth, without attempting to show minor variations, and the maps are made on a scale of one inch to six miles. A detail survey is made by the soil expert going over every section of land at close intervals, mapping all soil variations down to tracts as small as five acres, and even smaller. In both reconnoissance and detail surveys, not only the surface soil, but also the subsoil to a depth of three feet, and in some cases to a depth of six feet, is carefully examined by means of soil augers, for a knowledge of the subsoil frequently is of great significance to the agricultural value of the surface soil.

The soil survey maps accurately locate all important physical features, such as roads, railroads, streams, towns, churches, farmsteads and ranches, and include accurate mapping of the various soil types.

APPROXIMATELY 22,000 SQUARE MILES COVERED BY SOIL SURVEY DURING YEAR

During the year a reconnoissance survey of an area in Northwest Texas, comprising the counties of Bailey, Lamb, Hale, Floyd, Motley, Cottle, Hardeman, Foard, Knox, King, Dickens, Crosby, Hockley, Cochran, Yoakum, Garza, Terry, Lynn, Kent, Stonewall, and Haskell, embracing about 20,000 square miles, was completed. In this survey were found thirty soil types and major soil divisions, all of which were mapped, and all of which are suited to some form of agriculture. Detail surveys were made of two counties, Erath and Red River, and maps

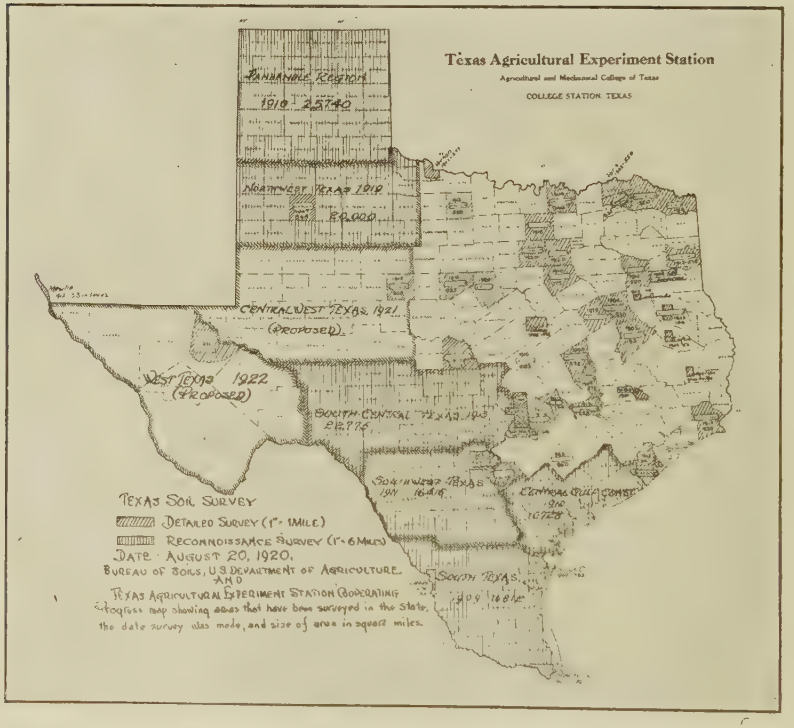

Figure 19.—Areas covered by soil surveys in Texas.

and reports prepared. Detail surveys were partially completed of Tarrant and Dallas counties, thus showing an area of approximately 1800 square miles covered in detail, and embracing nearly 100 different soil types. Detail surveys and maps were also prepared for the farmstead of Substation No. 7, Spur; for the John Tarleton Agricultural College lands at Stephenville, and for the Grubbs Vocational College lands at Arlington, Texas. Several thousand pounds of soil samples taken from

representative soil types were sent to the Station Chemist for analysis and report.

The year's work has brought the number of detail surveys by counties in Texas up to 53, leaving 200 counties as yet without detail surveys. In addition to this, however, a preliminary or reconnoissance survey has been made of either a part or all of 73 other counties in the State. This work has been greatly facilitated by cooperation between the Texas Station and the Bureau of Soils of the United States Department of Agriculture, by means of which the Federal government spends an equal amount of money with the State in inventorying the soil resources of Texas. One outstanding feature of this survey work is the fact that all of the money provided is put into actual field work, none being spent for overhead expenses. Its value and popularity is indicated by the fact that applications are now on file, supported by signed petitions from representative farmers and citizens for soil surveys in fifteen additional counties.

MORE BUSINESS NEEDED IN FARMING AND RANCHING

Agriculture is a business, a science, and a life. Sir Horace Plunkett, an authority on American rural conditions, says: "The improvement of rural life in America depends on better agriculture, better business, and better living." Of these three, "better business," he says, "must come first." Cyrus B. McCormick said: "Farming is a business and agriculture a science. The tiller of the soil who blends these two is the man to whom the future offers success." The fruit growers of California have demonstrated that increased production without better business defeats their own purposes, and that better business is the key to better living and better agriculture.

Better business in agriculture is concerned primarily with increasing the farmers' income. It involves the solution of economic problems on each individual farm or ranch, and it involves the solution of economic and social problems growing out of the relations of farmers among themselves and their relations as individuals and groups to other members of society.

Better business on the individual farm involves the problems of farm selection, farm planning, crop selection, and the many other problems connected with the proper combining of land, labor, capital, and managerial ability in bringing productive efficiency to its maximum. The larger aspect of better business in agriculture is concerned with solving such problems as land utilization in relation to ownership and tenancy, farm and ranch credits, farmers' business organizations, and marketing of farm and ranch products. The solution of these problems requires wide research and the most careful analysis, but the progress toward better business in agriculture is vitally dependent on advancements made in their solution.

FARM AND RANCH ACCOUNTS ESSENTIAL TO BETTER BUSINESS

The farmers of Texas produced over $800,000,000 worth of farm and ranch products in 1919. Less than one per cent. of this entire sum was produced under a system of accounting that will enable the producers to analyze their costs, and to adjust their producing organizations on a business basis.

An adequate system of accounts is the first essential in the adoption of an efficient working organization in any business. Agriculture is no exception to the rule. Studies have been made of different types of farming in Texas in order to emphasize the need of an adequate system of farm accounts, to stimulate the desire in the minds of the farmers for better business records, and to make clear to them the essentials of a system of accounts that is adapted to their particular line of business. The results of the study so far have been summarized in the form of a preliminary report in Bulletin No. 264, showing the benefits to be derived from keeping farm accounts, and the essentials in a good farm accounting system.

LABOR DISTRIBUTION AN IMPORTANT FACTOR IN DETERMINING FARM INCOME

Results of studies show that profits from Texas farms depend very largely on a successful labor distribution among the possible farm enterprises, and that no accurate conclusions may be drawn relative to the right proportions of such enterprises until the farmers have actually kept labor-time and expense records. These records will also prove helpful in analyzing the farm and ranch business, and in rendering inventories and income tax reports.

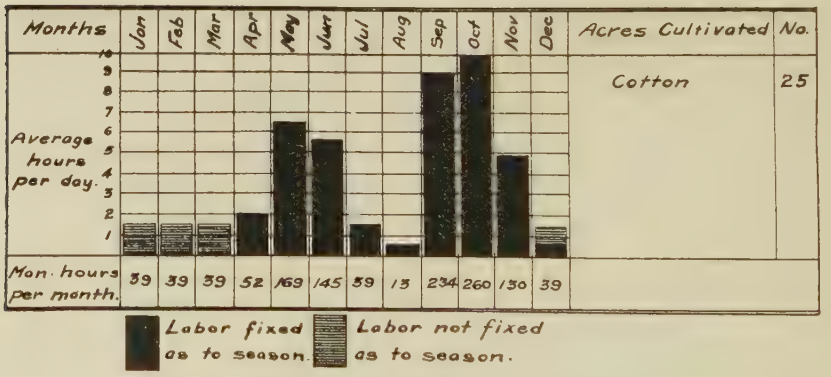

Figure 20.—One-crop farms have much unproductive time.

CURING AND STORAGE ESSENTIAL IN SUCCESSFUL SWEET POTATO MARKETING

The markets of the country cannot absorb at a profitable price the entire sweet potato crop at the time of harvest. If the commercial production of sweet potatoes is to be anything but disastrous to the growers, some means must be devised to cure, store, and market them

in an orderly way. Studies to date show that curing and storing are practical and that the market may be very greatly expanded. The most satisfactory house devised so far is the A. and M. 5000-bushel house shown in Bulletin No. 250.

FARMER-OWNED COTTON GINS

Some work has been done as to the possibility of cooperative farmers' gins. The results indicate that cooperative gins are not only possible but profitable. The chief problems arising in connection with the cooperative gins are the securing of efficient managers and sufficient finance. Some of the ways these problems have been solved are described in Experiment Station circular entitled "Farmers' Cooperative Gins in Texas."

GRADING, PROCESSING, AND HOLDING FARM AND RANCH PRODUCTS ARE OFTEN ESSENTIAL TO GOOD BUSINESSS

Better business in agriculture demands that the farmers and ranchmen grade, process, and hold their products for the purpose of securing the greatest net gain to themselves. Little attention has been given so far to the problem of merchandising farm products by farmers in Texas. It is a legitimate function of the farmer to put his product up in the most marketable form, to put it up with the least cost possible, and to sell it in the way that will give him the greatest profit.

SUBSTATIONS

The varied soil and climatic conditions in the State require the study of the agricultural problems within a given region by means of substations, or field laboratories. These field laboratories, located in the different agricultural regions, serve as bases for experiments with particular crops under certain conditions. For example, research with rice can be done only in the rice-growing region, as the soil and climatic conditions there allow the growth of this crop. Similarly, the grain sorghum breeding investigations must be conducted in a region where grain sorghums mature seed with certainty. Truck crops and fruit experiments must be made in the regions where these crops are grown. The breeding and production studies of the Angora goat must be done in a region where the animal is typically found.

Accordingly, the substations are working field laboratories for the study of agricultural problems existing in certain well-defined agricultural regions. The information gained in this way enables the Texas Agricultural Experiment Station to study first hand the problems of the different regions. The purpose of a substation is not to teach the farmers how to farm, but, rather, to gather knowledge relating to the more profitable methods of farming. Much information is gained by comparative work and therefore some of the operations observed

on the substations will appear less profitable than others. It should be borne in mind, however, that information is gained by the determination of which of a series is best, and on any well regulated experiment station both good and bad results will be seen in any year.

Figure 21.—The substation experiment farm, in addition to being a research field laboratory, is also a model of good farm practice.
Top: Substation No. 8, Lubbock.
Center: Experiment plat work at Substation No. 8.
Bottom: General view of farmstead, Substation No. 10, College Station.

SUBSTATION NO. 1, BEEVILLE

Location: Five and seven-tenths miles northeast of Beeville, at a siding on the G., H. & S. A. Railroad, called Poesta, and on the public highway.

Latitude: 28 degrees north.
Longitude: 97 degrees west.
Elevation: 240 feet above sea level.
Average rainfall for 25 years: 29.49 inches annually.
Rainfall for 1920: 22.31 inches.

This substation was established in 1895, originally for truck crops and orchard experiments. Owing to the increased importance of farm crops and soil fertility studies, work with rotations and cultural experiments, plant introductions, fertilizers and field tests with agronomic crops, was added in 1912. The results secured here are applicable in a general way throughout Southwest Texas, and specifically to a region of some twenty-five counties wherein the soil type and climatic conditions are the same.

The major purpose of this substation is to study the agricultural problems of the region. This can be done only by the conduct of production experiments with vegetables, fruits and other crops over a series of years, to arrive at a working average as to their suitability and profitableness in this section. Attention must also be given to the study of cropping systems, or rotations, for the permanent maintenance of soil fertility, as fertility in the land is fundamental to economical production in any crop.

The chief activity of the substation is the study of fruits, vegetables, and such farm crops as corn, grain sorghums, cotton, cowpeas, and grasses. Studies are also being made of dry-farming and tillage practices, and the use of supplemental irrigation for fruit and vegetable production.

The principal accomplishments of this substation in the past have included conclusions advising the use of supplemental irrigation for truck crops and citrus fruits in South Central Texas; a long-time series of experiments showing the necessity of heavy fertilization and manuring for the production of truck crops; the establishment of the superiority of the Satsuma orange in this region, and the continued successful production of this fruit year after year by proper management of the orchard and the occasional use of orchard heaters and irrigation. Bulletins Nos. 118, 148, 209, and other publications of the Station, give the details of the results secured at this substation.

The chief accomplishments of this substation in 1920 embrace conclusions from a test of forty varieties of olives planted in 1897 that two varieties, the Mission and the Manzanilla, are suitable for use in this section. A method of grafting these on other olive stocks has been perfected, which accomplishment should lead to a wider distribution of these two commercial olives. The experiments with citrus fruits which have this year produced a successful crop, have been conducted sufficiently long to ascertain the best varieties, and these are now being propagated for use in planting out larger orchards.

Burr clover was introduced on the substation several years ago, as a

green manure and pasture crop, and is now being used very successfully in the orchards as a winter cover crop, as a result of which burr clover is now being used generally in this section.

The work with corn and cotton has reached the stage where definite conclusions can be drawn. Thomas corn, a variety well adapted to conditions here, has been highly improved by selection, and seed is now being distributed to farmers. Cotton planted on soil which had not grown cotton for two years, showed practically no root rot, while cotton planted on land following cotton showed severe losses, indicating the value of crop rotation in combating root rot.

Figure 22.—Burr clover, a good soil improver, in foreground; olive trees, a promising crop for southwest Texas, in background.
Bottom: Citrus fruit orchard. Substation No. 1, Beeville.

SUBSTATION NO. 2, TROUP

Location: One mile northeast of Troup, in Smith County.
Latitude: 32 degrees north.
Longitude: 95 degrees west.
Elevation: 467 feet above sea level.
Area: 150 acres.
Average rainfall for 16 years: 42.96 inches annually.
Rainfall for 1920: 48.58 inches.

The agricultural region served by this substation is East Texas, but

as the chief work done applies to fruits and vegetables, it has been noted that much of the substation"s results apply in all of Texas except the extreme southern and western parts of the State.

The major purpose of this substation is to conduct systematic investigations relating to mixed and diversified truck fruit, vegetable, and crop farming, for the fruit and vegetable district of East Texas. Of necessity, this includes extensive experiments with adapted or probably adapted nuts, fruits, berries, grapes, vegetables, and tuber (root) crops, as well as with farm crops, clovers, grasses, and so forth. It includes also studies in the application of fertilizers to crops and the use of various rotations, to determine the farm practices best suited to the building up and maintaining of soil fertility. There are also many investigations necessary in the control and extermination of plant diseases and insect pests which are especially in evidence in such work as this.

Among the major accomplishments of this substation in the seventeen years since its establishment may be mentioned particularly the actual growing for comparison of 134 varieties of peaches and 118 varieties of grapes, and the publication of the results secured.

Fertilizer practice in the East Texas tomato growing district is based on results secured in experiments conducted here.

During the season of 1920, this substation developed further facts relative to the effect of fertilizers on the control of diseases of the tomato. The study and testing of adapted foreign and native fruits were productive of much additional information. The experiments with Triumph seed potatoes from different sources showed that the condition and the maturity of the planting potato are very important. The cotton variety experiments were productive of valuable information, and it would appear that the results of this work are now sufficiently conclusive for publication and the data are in the process of preparation for publication at an early date.

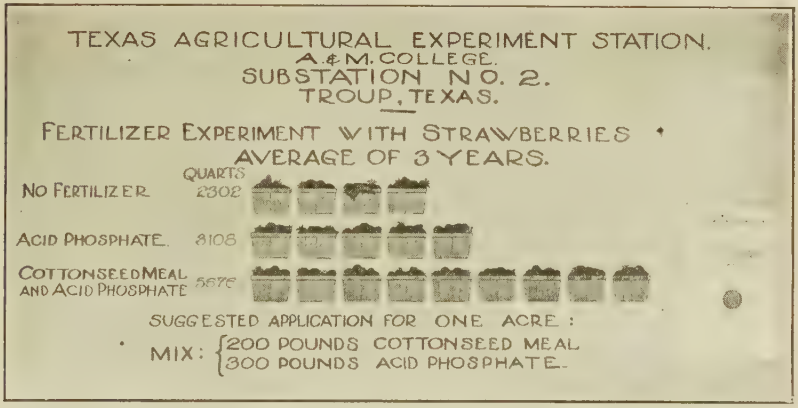

Figure 23.—Results of fertilizer experiments with strawberries. Substation No. 2, Troup.

Figure 24. *Cedrus deodora*, a beautiful ornamental tree at Substation No. 2, Troup.

SUBSTATION NO. 3, ANGLETON

Location: Three and six-tenths miles northeast of Angleton, Brazoria County, and adjacent to the St. L., B. & M. Railroad.

Latitude: 29 degrees north.
Longitude: 95 degrees west.
Elevation: 25 feet above sea level.
Area: 157 acres.
Average rainfall for seven years: 45.57 inches annually.
Rainfall for 1920: 49.28 inches.
Number of experiments in 1920: 673.

The agricultural region served by this substation is the Central Gulf Coast country of Texas and the adjacent river bottom lands.

The major purpose of the substation is to work out drainage and crop production practices for the flat and comparatively poorly drained region which is not planted to rice, and to provide conclusions on which to furnish the farmer with information that will enable him to develop a high type of general diversified live stock farming in the region. At the present time the region is largely used as range for live stock and for a rather non-diversified system of farming. To carry out the substation's plan will require the complete development of main drainage canals, the installation of experiments in tile drainage, and the extensive testing of crops and plants from all over the world to determine their suitability for local conditions, and the study of practices in crop production and the maintenance of fertility which will be practical enough to yield a working profit at all times.

The major accomplishments of this substation in the past have been the testing of the best varieties of general farm crops for this region, such as corn, cotton, cowpeas and peanuts, and the most favorable rate and date of planting these crops. The introduction of new grasses and forage plants has been a positive accomplishment. Successful grasses that have been tested and recommended to farmers of the region by the substation include Rhodes grass, Napier grass, Para grass, Giant Bermuda grass, and *Andropogon annulatus*. Japanese sugar cane, an unusually good forage crop, introduced by the substation, has been found to be particularly adapted to the region.

The principal accomplishments of the substation in 1920 are as follows: In the cotton variety test, Mebane and Acala were the highest yielders, each producing 319 pounds of lint cotton to the acre. The results of cotton variety tests since the beginning of investigational work at this substation will be published soon in Bulletin No. 274, entitled "Cotton Variety Experiments, Substation No. 3, Angleton, Texas."*

The better varieties of cotton recommended for this region are Mebane, Lone Star, Kasch, and Acala.

The corn variety experiments showed the best yields from Virginia White Dent, Fentress Strawberry, and Ferguson's Yellow Dent. Results of corn variety experiment work at this substation since its establishment will be given soon in Bulletin No. 276, entitled "Corn Variety

*Since the preparation of this report and before its publication, these bulletins have been published and distributed.

Experiments, Substation No. 3, Angleton, Texas."* In this bulletin the varieties recommended are Fentress Strawberry, Hastings Prolific, Ferguson's Yellow Dent, Thomas, and Tuxpan.

A continuation of good results was secured in the experiments with a large number of grasses new to conditions in the region, and these grasses are now being distributed to farmers as opportunities present themselves.

The 1920 annual report of this substation to the Director, covering all experiments conducted during the year, will contain, when finally copied, about 300 pages of typewritten material.

Figure 25.—New crop introductions in the Gulf coast country that have proved to be valuable additions to the crops grown there.
Top: The dasheen, a substitute for Irish potatoes.
Bottom: Japanese sugar cane, a forage crop extremely well suited to the region.

SUBSTATION NO. 4, BEAUMONT

Location: Six miles west of Beaumont, on the S. P. and B., S. L. & W. Railroads.
Latitude: 30 degrees north.
Longitude: 94 degrees west.
Elevation: 26.5 feet above sea level.
Area: 100 acres.
Average rainfall for 28 years: 49.92 inches annually.
Rainfall for 1920: 57.77 inches.
Number of experiments and tests in 1920: 740.

The agricultural region served by this substation is the low, flat, poorly drained area along the Gulf coast from the eastern boundary of the State to the mouth of the Colorado river, and the river bottoms and the low-lying country in Southeast Texas.

The principal purpose of the substation is to render a profitable and permanent service to the rice farming industry of the State, by encouraging the use of better and more adapted or suitable varieties of rice, and the introduction of new varieties from other countries, by studies of the better methods of irrigation, tillage, and fertilization of rice fields in order to increase the acre-yield or make more permanent the use of rice lands, and to assist the growers in lowering the cost of production per unit. It is also one of the purposes of this substation to discover fruits and vegetables suitable to rice lands, and to find crops which can be introduced and made to grow in a practical way on these rice soils, to the end that the rice farm need not be one which is usable for only a few years.

The major activity of this substation consists of studies with rice and such crops and crop practices as may be used to supplement rice farming.

The principal accomplishments of the season of 1920 were a confirmation of previously secured results in the use of sulphate of ammonia as a fertilizer for rice, and further observations on new forage plant introduced from Brazil under the name of *Lagriminas de Nossa Senhora,* which seems to offer great possibilities as a forage crop on rice lands, and may be even more successful than the Japanese sugar cane which has become so well established in this region as a forage crop.

Outstanding features of previous work on this substation have consisted of the working out of methods of applying intertillage to rice to conserve irrigation water, and to kill weeds; the development of information relative to fertilizers for rice, particularly with reference to their being applied rather late in the spring; the conduct of experiments showing that rice planted relatively late in the season will make better yields than medium or early plantings, and the development of a number of pedigreed strains of foreign rices in competition with domestic varieties.

A detailed report of each and every experiment and test carried at this substation during the year consisting of 250 typewritten pages, has been prepared and filed with the Director.

SUBSTATION NO. 5, TEMPLE

Location: Four and one-half miles southwest of Temple, and four miles northeast of Belton, and adjoining the Temple-Belton interurban and highway.
Latitude: 31 degrees north.
Longitude: 97 degrees west.
Elevation: 740 feet above sea level.
Area: 96 acres.
Average rainfall for eight years: 37.63 inches annually.
Rainfall for 1920: 44.73 inches.

The agricultural region served by this substation is Central Texas.

The major purpose of this substation is to develop constructive facts on which to base advancement of the permanent agriculture of Central Texas. To this end, soil fertility, tillage, and plant diseases are being intensively studied. Crops that are resistant to root rot are being sought for, both for primary utilization and for soil improvement. Tile drainage is being studied and developed to promote soil productivity and to aid in crop production. Fertilizers for the rich black soils are being studied, and crop rotations are being developed. A further purpose of the substation is to find or develop better producing crops, through extensive plant variety tests, crop introduction experiments, and crop improvement work.

The chief activity of the substation consists of experiments with general farm crops, and especially studies of cotton and cotton diseases.

The outstanding accomplishments of this substation in the past have included the introduction of Sudan grass as a successful crop in the central part of the State; the finding that crop rotation will largely control or reduce to a negligible quantity the damage from root rot; the development of Belton cotton; the testing of a large number of varieties of farm crops, and the determination of the fact that only a few varieties are really well adapted and have made high yields here.

The principal accomplishments of the substation in 1920 are the continued successful production of Belton cotton, a variety which has been produced by selection on this substation. Seed of this variety is being increased for distribution to farmers during the coming winter. Another result of the year's work is the confirmation of previous results which show that guar is fully resistant to root rot. Guar is a legume introduced from India, and is suitable for a soil improvement crop on root rot infected land. A study of the various types of guar was made this year to furnish a basis for the local improvement of the crop, the plant-type of which is somewhat variable, and seed is being increased for distribution to farmers.

SUBSTATION NO. 6, DENTON

Location: Five and one-half miles northwest of Denton, Denton County, on the Denton-Krum pike.
Latitude: 33 degrees north.
Longitude: 97 degrees west.
Elevation: 600 feet above sea level.
Area: 203 acres.

Average rainfall for eight years: 38.35 inches annually.
Rainfall for 1920: 49.35 inches.
Number of experiments in 1920: 2674, of which 2167 were with small grains.

The agricultural region served by this substation is Central North Texas.

The major purpose of the substation is to make available facts, practices, and crop material which will render it practical and profitable to use these lands for diversified farming and intensive live stock production. It is necessary that the lack of drainage in the heavy soils be studied; that clover or other soil improvement crops be found which will be capable of not only practical use for live stock, but also for secondary use in maintaining fertility. It is necessary that the Mediterranean wheat that has been so successfully grown in this section be purified and made to be higher yielding, and the better milling strains segregated, proved, and put into general use. A further purpose of this substation is to find adapted fruits, vegetables, and forest trees which will grow on the heavy lands, and means of making their growth desirable.

The principal activity of this substation consists of the study of small grains of all kinds, including tests of standard varieties, well known varieties masquerading under new or unusual names, varieties introduced from different parts of the world, and new varieties coming on the market. The substation is also studying the best varieties of other farm crops that are adapted to this region, including cotton, corn, sorghums, cowpeas, clovers, and grasses, and the different methods of producing these crops, and in addition to this, practical means of maintaining soil fertility and crop yields.

The outstanding accomplishments of the substation in the past have been the testing and elimination as unsatisfactory for the region, of hundreds of varieties of small grains secured from every possible location, including a large number of types and varieties furnished by farmers. A further accomplishment has been the conduct of experiments which indicated the absolute necessity of deep early plowing, followed by adequate clean tillage during the summer, as a preparation for planting winter wheat. A further accomplishment has been the introduction and popularizing of white sweet clover as a farm crop in the region.

The principal accomplishments of the season of 1920 were as follows: Experiments showed that Surcropper, Strawberry, and Oklahoma White Wonder continue to be the best yielding varieties of corn here. Mediterranean wheat was shown to be the best yielder, and that of the hard red winter wheats the Kanred is the best, and very closely follows the Mediterranean in yield here. Considerable plantings of pure-line strains of Mediterranean wheat were available for field testing, and showed their superiority over the mixed plantings. The Appler oat, a red rust-proof type, continued to give excellent yields, as also did T. S. No. 1118, and Ferguson's 71. In the pure-line selection work with the Appler oat, among many failures and unsatisfactory yields in the experiments, several pedigreed strains were found which yielded more than 100 bushels to the acre. These were increased for further testing. White sweet clover has been found to be a very satisfactory legume crop in this re-

Figure 26.—The farmers are interested in the work of the Station. A typical gathering of North Texas farmers at Substation No. 6, Denton.

gion, and is now being grown on practically one-tenth of the area of the substation, where it is proving to be an excellent hay and pasture crop, in addition to its value in rotations with small grains where it is having excellent effects.

The annual report for 1920 to the Director consists of 225 pages of typewritten manuscript, giving detailed reports on the various experiments and tests conducted during the year.

SUBSTATION NO. 7, SPUR

Location: One mile west of Spur, in Dickens County.
Latitude: 33 degrees north.
Longitude: 100 degrees west.
Elevation: 2274 feet above sea level.
Area: Owned, 160 acres; leased, 246 acres; total, 406 acres.
Average rainfall for 26 years: 22.08 inches annually.
Rainfall for 1920: 28.0 inches.

The agricultural region served by this substation is that of the red lands below the Cap Rock of the Plains, known as the Permian Redbeds region. The virgin land naturally furnishes grazing of the finest quality. When brought into cultivation it is well adapted to crop farming, particularly to such crops as the grain and forage sorghums, Sudan grass and alfalfa, all of which are so valuable and necessary in live stock farming.

The major purpose of this substation is the development of agricultural information leading toward stable types of farming and ranching in the region. The introduction and development of new crop varieties, the study of soil moisture conservation and dry-farming practices, and the utilization of the crops grown through live stock maintained on the farm, all contribute basic information as to reliable farming and ranching practices in this territory.

The major accomplishments of the substation in the past have included the isolation of a strain of feterita, different from any other, and its production, increase and distribution of seed in sufficient quantity to establish it as a staple crop among the farmers. This feterita, known as Spur Feterita, is now the most popular feterita in West Texas, and has produced through a period of six years an average of more than seven bushels more grain to the acre than the common or unimproved feterita* Another marked accomplishment of this substation has been the successful and profitable production of alfalfa under dry-land conditions. This crop has come to be particularly profitable in the valleys of the region. Still another accomplishment has been the variety experiments with cotton which have shown that the Texas big boll cottons are best adapted to conditions in this region.

In the live stock work at this substation among the chief accomplishments in the past may be mentioned the feeding tests with grain sorghums which showed that they may be substituted for corn in a lamb fattening ration and will produce practically the same gains as corn, but at a lower cost. In feeding tests with baby beeves, it has also been shown that when substituted for corn in a fattening ration, the grain

*Since the preparation of this report, and before its publication, Bulletin No. 275, entitled "Spur Feterita," has been issued.

sorghums will produce practically the same gains as produced by corn, but at a lower cost. It has also been determined that smooth-bodied Rambouillet lambs make practically the same gain in the feed lot as the cross-bred lambs out of fine wool foundation, and that the Rambouillet lambs finish in the same length of time and bring a top market price when marketed in prime condition. Further, it has been determined that there is no advantage to be gained by docking young lambs with the searing iron or docking pincers. This operation can be performed more quickly with the knife, and apparently with no great danger of fatalities due to excessive bleeding.

The principal accomplishments of this substation in 1920 in agronomic work have included studies indicating that rather thin seeding of alfalfa in drills is to be advised here under dry-land conditions; that superior strains of alfalfa can be established by isolating and increasing high-yielding individual plants. Seventeen thousand individual plants have been planted, spaced uniformly one foot apart each way, and have shown marked variation in type and growth of plant under uniform conditions, and have provided material indicating definitely the superiority of certain individual plants, which are being observed further and increased for distribution to farmers.

In the live stock work here, feeding experiments with lambs have shown that the grain sorghums can be used more profitably than corn for fattening lambs in Western Texas. In the tests made during the year, the lambs receiving a ration including ground milo heads made the most economical gains of all lots, which is a very important fact, since by the use of the ground heads the producer would avoid the expense of threshing the grain.

SUBSTATION NO. 8, LUBBOCK

Location: Three miles east of Lubbock, Lubbock County, on the Lubbock-Crosbyton highway.
Latitude: 33 degrees north.
Longitude: 101 degrees west.
Elevation: 3200 feet above sea level.
Area: 160 acres.
Average rainfall for 10 years: 20.42 inches annually.
Rainfall for 1920: 18.16 inches.
Number of experiments in 1920: 2060.

The agricultural region served by this substation is the Plains region of Northwest Texas.

The purpose of the substation is to find suitable crops and suitable methods of producing them, to enable more profitable farming in the region. One of the major purposes of the substation is the breeding and improvement of grain sorghums, and the study of the use of windmill irrigation for the production of home gardens and orchards and for limited crop farming. The underlying principles of dry-farming and permanent soil fertility under the conditions existing in this region will also be investigated.

The principal accomplishments of this substation in the past have consisted of the introduction and distribution of Sudan grass and feterita as staple crops on the Plains, and this work, in turn, has resulted

in the development of an important region for the production of agricultural planting seeds, particularly of grain sorghums, Sudan grass, and other crops suited to the territory. The substation also has been largely instrumental in establishing cotton as a crop on the Plains. The work here has also shown a great number of vegetables and fruits to be well adapted to the region, which, if supplied with a small amount of supplemental irrigation by means of windmills or otherwise, should

Figure 27.—Windmill irrigation is highly profitable on the South Plains for irrigating the home garden, orchard, and ornamental trees. Substation No. 8, Lubbock.

become very profitable as a home enterprise and for the marketing of the surplus.

The principal accomplishments of the season of 1920 were the production of high yields of cotton. Burnet cotton gave the highest yield with 582 pounds of lint cotton to the acre; Mebane came next with 477 pounds of lint cotton to the acre, and Lone Star yielded 398 pounds

of lint cotton to the acre. Durango, a variety of staple cotton, gave a yield of 259 pounds of lint cotton to the acre. A pure-line kafir was established, the strain of which has been a high yielder for three succeeding generations, and alimited amount of seed has been distributed to farmers. Further confirmation was secured of the fact that cross-fertilization in grain sorghums can be practically eliminated if reasonable precautions are taken. Eleven hundred and seventy-seven shade and ornamental trees, of the varieties tested here and found adapted, were distributed. It has been found by the study of pure-lines of kafir established, that any single character can be established or fixed in the second generation, indicating the ease with which the grain sorghum growers can obtain higher yielding strains.*

The 1920 annual report of this substation to the Director, when typewritten, will contain approximately 500 pages.

SUBSTATION NO. 9, PECOS

Location: Three and one-half miles west of Pecos.
Latitude: 31 degrees north.
Longitude: 103 degrees west.
Elevation: 2580 feet above sea level.
Area: 80 acres.
Average rainfall for seven years: 11.64 inches annually.
Rainfall for 1920: 19.7 inches.
Number of experiments in 1920: 1265.

The agricultural region served by this substation is the central part of extreme West Texas, known as the Trans-Pecos region, although the findings of the substation apply to a considerable degree as far southeastward as Del Rio, and as far westward as El Paso.

The major purpose of this substation is to develop a working basis for crop and live stock farming in the irrigated regions of West Texas, and to not only discover introduced adapted crops and crop varieties, but also to establish the principles of upbuilding the newer types of irrigable soils which are particularly lacking in humus and in general are unsatisfactory for the production of vegetables and truck crops, and to secure information on the cost and methods of applying and using irrigation water.

The principal activity of the substation consists of carrying out experiments in the growing of cotton, sorghums, alfalfa, and cantaloupes, all under irrigation.

The principal accomplishments of the substation in 1920 were that Canadian Variegated, Grimm, Turkestan, and Chilean varieties of alfalfa are decidedly unadapted in this region, and that the Peruvian and common American seem to be the best adapted.

The conclusions reached in 1919 that much more irrigation water was necessary for alfalfa than is ordinarily applied in this region, were more than supported by the 1920 work. This year, by the liberal use of water, yields of 6800 pounds of cured alfalfa hay to the acre were secured, from alfalfa planted in 1917. From the 1918 planting, a yield

*Since the preparation of this report and before its publication, Bulletin No. 279, entitled "Type and Variability in Kafir," has been issued, giving the details of the work referred to.

of 4600 pounds to the acre was secured, while the 1919 planting yielded 3400 pounds to the acre.

In the matter of providing pasture for live stock on irrigated farms, experiments indicate that oats, Freed sorgo, Sudan grass, alfalfa, and possibly sweet clover, all are very satisfactor crops for this purpose. Attention is directed to the fact that the farmer should take advantage of local opportunities for irrigating grazing crops instead of depending on comparatively large amounts of unirrigated land for pasturage.

The variety test of cotton resulted in the production of 204 to 255 pounds of lint to the acre, the varieties Durango, Snowflake, Lone Star, and Acala, all producing lint from 1 1/16 to 1 3/16 inches in length. The continued success of Durango and Snowflake further confirm previous results secured at this substation.

A large number of varieties of American and exotic shade and forest trees are being tried out, and some of them seem to be well adapted to this region.

The principal accomplishments of this substation in the past have been the establishment of the cotton growing industry in the region served by the substation, and the repeated calling of attention to the fact that it is possible to grow staple cotton here, and the fact that the yields of staple cotton are nearly as good and sometimes better than the yields of the short staple varieties, and furthermore, that cotton can be grown here with a considerable saving of irrigation water over and above the amount usually required by other crops adapted to the region. It has been shown also that for the successful production of alfalfa considerable proportions of irrigation water must be used; that cantaloupes can be produced locally and shipped to Central Texas points in competion with the product from other sources.

The annual report for 1920, reporting upon each and every experiment and test conducted during the year, consisting of 250 typewritten pages, has been filed with the Director.

SUBSTATION NO. 10, COLLEGE STATION; FEEDING AND BREEDING SUBSTATION

Location: One mile northwest of College Station, in Brazos County, on public highway.

Latitude: 30 degrees north.

Longitude: 90 degrees west.

Elevation: 308 feet above sea level.

Area: Station-owned land, 265.8 acres; College land assigned to Station, 636 acres; total, 901.8 acres.

Average rainfall for 30 years: 37.35 inches annually.

Rainfall for 1920: 43.65 inches.

The major purpose of this substation is to provide a central location near the Main Station and the Agricultural and Mechanical College for studies in the feeding, breeding and management of all kinds of live stock. To carry out the work it has been necessary to develop facilities adequate for the purposes, and with the development of the physical equipment has come the necessity for the creation or upbuilding of herds and flocks wherein the experiment material may be produced. This substation investigates the principles of feeding Texas-grown feed-

ing stuffs to the end that the farmers and stockmen of the State may be fully informed of the abundant resources open to them in the utilization of their feeds, whether grains, mill by-products, dry forage or silage crops. It is the purpose of the substation to study the principles of animal breeding, the rate of development of different breeds of live stock, and the productive capacity and the economics of live stock production.

The principal accomplishments of this substation during 1920 have included experiments showing that hogs can be safely grazed on peanuts preliminary to the fattening period without the danger of producing soft pork, and that considerable quantities of rice bran can be fed to fattening hogs, in as high a proportion as 60 per cent. of the ration, without causing soft pork. Hogs fed by means of a "free choice" self-feeder made the greatest gains, but at a greater cost of feed. Steers fed on a ration substituting silage in part for cottonseed hulls showed that when cottonseed hulls are worth $9.00 a ton, silage is worth $5.40 a ton, and that in considering the relative values of the two feeds it should be borne in mind that silage is a good appetizer. It has been shown that cottonseed meal, a vegetable protein feed, can be substituted for meat scrap, an animal protein feed, for laying hens, to the extent of 45 per cent. of the ration, and that tankage is almost as satisfactory as meat scrap for egg production.

Figure 28.—Four-hundred-ton concrete silo on Substation No. 10, College Station.

SUBSTATION NO. 11, NACOGDOCHES

Location: Two and three-fourths miles north of Nacogdoches, in Nacogdoches County, on the Nacogdoches-Timpson highway.
Latitude: 32 degrees north.
Longitude: 94 degrees west.
Elevation: 292 feet above sea level.
Area: 82.5 acres.
Average rainfall for 20 years: 47.66 inches annually.
Rainfall for 1920: 52.33 inches.
Number of experiments in 1920: 714.

The agricultural region served by this substation is the south central portion of East Texas, particularly the more or less sandy pine lands and the red lands of the Orangeburg classification.

The major purpose of the substation is to provide a workable and profitable system of permanent agriculture for the earliest settled farm lands in Texas. To bring this about, it is necessary to test new crops, improve established crop varieties when experiments have shown that they are the most suitable for the region, and to build up the physical and chemical qualities of the soil to the point that crop production may be carried on with reasonable assurance of profit—in many instances a thing very difficult to do in this part of the State on account of the condition of the soil. It is also the purpose of this substation to develop scientific principles underlying the improvement of adapted crops which have not as yet been worked out by plant breeders and research workers.

The principal accomplishments of this substation in the past have been the conduct through a number of years of a series of fertilizer tests with tobacco, corn, cotton and tomatoes, all of which have shown that with crop rotation and the liberal use of fertilizers, chiefly acid phosphate and cottonseed meal, and with rigid attention paid to the keeping up of a supply of humus in the soil, very profitable yields of a variety of farm crops can be had in this region. Other outstanding results are the improvement of the Spanish peanut and of the Bluegrain corn, together with tests of adapted varieties of cowpeas.

The principal accomplishments of this substation during the season of 1920 consist of the production of three-fifths of a bale of Acala cotton to the acre in the variety test. This cotton produced a staple of one and one-eighth inches. Quite definite conclusions were obtained as to the best adapted varieties of cotton, through experiments which have been conducted long enough to render the conclusions reliable. A progress bulletin is now in course of preparation, in which these tests will be described fully.

A cotton rate-of-planting experiment, in progress for six years, was continued, and the results indicate that the best yields have been secured from three plants in a hill, and that check-row planting may be made as productive as any other method of planting, and that a relatively high number of plants should be carried to the acre, instead of thin planting, when the land is in a good state of fertility.

A variety of corn known as Bluegrain (T. S. No. 935) has been grown for several years in ear-to-row selection plats, for the improvement of yield. In the present crop, the best yielding strain produced eight times as much grain as the poorest yielding strain, thus illustrat-

ing the fact that constant attention is necessary to keep a variety up to standard.

Notwithstanding the extremely high cost of fertilizers used in the tobacco fertilizer experiments, the plat that was fertilized heavily with cottonseed meal and acid phosphate showed a net profit during the year, which is a further confirmation of previously secured results.

The 1920 annual report to the Director, reporting in detail upon each and every experiment, when typewritten, will contain approximately 350 pages.

SUBSTATION NO. 12, CHILLICOTHE

Location: Four and one-half miles south and one mile west of Chillicothe, in Hardeman County, on public highway.

Latitude: 34 degrees north.

Longitude: 99 degrees west.

Elevation: 1406 feet above sea level.

Area: 100 acres.

Average rainfall for 15 years: 26.34 inches annually.

Rainfall for 1920: 37.69 inches.

Number of experiments in 1920: 647, of which 525 were with sorghums.

The agricultural region served by this substation is that of the northern part of the Redbeds region and the eastern Panhandle. The reliability of the results secured, however, will extend as far southward as Albany.

The work here is conducted under the terms of a cooperative agreement with the Office of Forage Crops Investigations, Bureau of Plant Industry, United States Department of Agriculture.

This substation is primarily a forage crops testing farm, and studies are made of all phases of the production of adapted forage crops and their relation to the other suitable crops of the region.

The principal accomplishments in the past have been the introduction and testing of Sudan grass for the first time in the United States, which was followed by the successful distribution and use of the crop throughout the United States. At this substation feterita was first introduced. Alfalfa has been found particularly well suited here and is now being quite generally grown. More than two thousand sorghums never before grown in the United States have been tested here, and although many of them have been found worthless, new types have been found which give promise of being of great value.

The principal accomplishments in 1920 were the continuation of the tests with new sorghum crops, and the successful production of an extremely large number of adapted varieties under conditions which gave a good opportunity for conclusions as to the suitability of many varieties new to the trade or which are merely old and unsuitable ones masquerading under new names. Kanred wheat has been shown by the tests to be superior to any other variety, both in yield and in quality. Early deep preparation of the seedbed for wheat, followed by clean tillage, produced the most gain. Late, indifferent listing produced the least grain. In the cotton cultivation experiments, where other conditions were equal, weeds and grass in the field were found to be the

chief causes of reduced crops, rather than the presence or absence of a soil mulch.

The 1920 annual report of this substation to the Director, covering all experiments and tests made, will contain, when typewritten, approximately 275 pages.

SUBSTATION NO. 14, SONORA

Location: Twenty-six miles southeast of Sonora, in Sutton-Edwards Counties, on the Sonora-Rock Springs public road.
Latitude: 30 degrees north.
Longitude: 100 degrees west.
Elevation: 2400 feet above sea level (estimated).
Area: 3452 acres.
Average rainfall for three years: 27.0 inches annually.
Rainfall for 1920: 25.51 inches.

The region served by this substation is the Angora goat and sheep producing center of Southwest Texas, in which is produced nearly one-half of the entire clip of domestic mohair of the United States. This is a ranch substation, situated in the Edwards Plateau country, 98 miles south of San Angelo, and 65 miles north of Del Rio, the two most accessible railroad stations.

The major purpose of the substation is to provide definite facts on which the business of the ranchmen in the true ranch country of Texas may be developed on a sound basis. This necessitates the working out of the adapted breeds of sheep and goats, and other live stock; the age at which they are the most suitable for marketing, methods of caring for and renovating the range so as to make it more productive, and the study of the animal diseases and insect pests which are peculiar to the ranch country, chief among which may be mentioned the swell head disease, the stomach worm, and various other diseases and insects. Purebred sires are being used in the breeding operations, with the view to improving the several classes of live stock.

The principal accomplishments of the substation in 1920 were the continuation of the upbuilding of the herds and flocks, and a determination of a practical method of controlling flies, and the collection of data relating to swell heap of sheep and goats.

Figure 29.—Distribution of goats in the United States. Goats are of minor importance in the United States, except in Southwestern Texas, where in Edwards and seven other counties, about one-fourth of the 3,000,000 goats in the country are found. There are considerable numbers of goats in New Mexico, Arizona, and the Willamette Valley of Oregon. The latter is a moist region where Angora goats are used largely for clearing underbrush from cut-over land. A few goats are scattered through the Southern States and up the Mississippi Valley as far as Iowa. Goats are an important farm animal in the United States only in the rough, semi-arid Edwards Plateau region of Texas and in the valleys and plateaus of New Mexico and Arizona.

Figure 30.—Top: A typical Angora goat ranch in Southwest Texas.
Bottom: A good Angora buck.

COOPERATION

In accordance with the fixed policy of the Station to cooperate wherever cooperation is mutually advantageous, the following memoranda of cooperation have been continued or entered into:

1. With the Office of Dry-Land Seed Distribution, United States Department of Agriculture, for cooperative work in the dissemination of dry-land crops suitable to Texas conditions.

2. With the Office of Forage Crop Investigations, United States Department of Agriculture: (a) in the operation of Substation No. 12, Chillicothe; (b) in special forage crops studies at Substation No. 3, Angleton, and (c) in general forage crops investigations throughout the State.

3. With the Office of Foreign Seed and Plant Introduction, United States Department of Agriculture, for the introduction, propagation and testing of newly introduced plants giving promise of becoming valuable in Texas.

4. With the Office of Cotton and Truck-Diseases and Sugar-Plant Investigations, United States Department of Agriculture, for general cooperative work on plant diseases in Texas, and for a plant disease survey of the State.

5. With the Office of Horticultural and Pomological Investigations, United States Department of Agriculture, for (a) the propagation and distribution of rosaceous fruits in Texas, and (b) for the testing of Northern-grown certified seed of Irish potatoes in comparison with seed of local and State origin.

6. With the Bureau of Soils, United States Department of Agriculture, for cooperative soil surveys in Texas; the Division of Soil Survey being thus operated.

7. With the Seed Laboratory, United States Department of Agriculture, for the operation of a seed laboratory in the Division of Agronomy of this Station.

8. With the Bureau of Markets, United States Department of Agriculture, for cooperative investigations in marketing in the State; this work being carried on through the Division of Farm and Ranch Economics of the Station.

9. With the Bureau of Entomology, United States Department of Agriculture, for cooperative work in the sheep and goat region of Southwest Texas in investigations of insects and external parasites affecting live stock.

10. With the Bureau of Chemistry, United States Department of Agriculture, whereby the Director is appointed a Federal inspector under provisions of the Food and Drugs Act of 1906, for the purpose of more efficiently enforcing the laws regulating the sale of feeding stuffs in Texas by out-of-State manufacturers and dealers.

11. With the National Defense Council, through the Office of Experiment Stations, in the prosecution of a cooperative study in composting of raw phosphate rock and sulphur with different soils.

12. With the School of Agriculture, A. and M. College of Texas, wherein Station men may give lectures to students, and teachers may do cooperative investigation work on the Station.

13. With the School of Engineering, A. and M. College of Texas,

wherein certain professors may cooperate in agricultural studies involving engineering problems.

14. With the School of Veterinary Medicine, A. and M. College of Texas, wherein the Dean of the School of Veterinary Medicine acts as Chief of the Station's Division of Veterinary Science.

15. With the Extension Service, A. and M. College of Texas, whereby the extension workers from time to time suggest the more important problems confronting the farmers and stockmen of the State.

16. With the Dallas County Seed Breeders and Cooperative Association, wherein Station officials advise with the farmers of that county as to the growing of pure strains of cotton, corn, and other field crops, for the production of pure seed.

STATION LANDS

The following is a tabular statement of the lands owned and operated by the Texas Agricultural Experiment Station system in connection with investigational work:

Designation.	Total area in acres.	Acres in cultivation.	Acres in pasture.	Acres in farmstead, roadways, and miscellaneous.
Main Station, Agronomy Farm	127	98	11	18
Division of Veterinary Science	141	5	130	6
Substations:				
No. 1	151.5	63.2	84.3	4
No. 2	150	50	90	10
No. 3	157	51	100	6
No. 4	100	60	10	30
No. 5	96	30	62	4
No. 6	203	163	37	3
No. 7	*406	104	*292	10
No. 8	160	109	41	10
No. 9	80	77.1	** 0	2.9
No. 10	***901.8	212	674.8	15
No. 11	82.5	33.4	38.9	10.2
No. 12	100	80	10	10
No 14	3452	65	3187	200
Total	6307.8	1200.7	4768	339.1

*Includes 246 acres leased for pasture.
**6.1 acres in cultivated pasture.
***Includes 636 acres of College land assigned to Experiment Station work.

PUBLICATIONS

New facts about Texas agriculture as developed by the research work of the Experiment Station are printed in bulletin form, in circulars and press bulletins for distribution without cost to the people. The use of these bulletins has become increasingly popular, and since the war period has been so heavy as to overtax the Station's facilities.

At one time more than ten thousand addresses were on file to be placed on the regular mailing list and awaiting the cutting of address stencils.

There are 435,666 farms in Texas, every one of which should receive new farm facts as soon as developed by the Station for use in their successful operation. Naturally, it becomes necessary to devote more funds toward the publication and distribution of the results of agri-

cultural research as the demand for it increases, but since the chief expense of knowledge is the finding of it, rather than its publication, and since knowledge only benefits man when applied, it is encouraging to observe the approaching necessity for the expenditure of considerably larger sums of money in printing and distributing Station bulletins.*

In the endeavor to meet the demands for Station publications, editions have run so low as to leave in reserve very small numbers, and as these bulletins are valuable for many years, the reserve should be enough to supply the demands for it for at least five years. Of the bulletins published during the current fiscal year 25 per cent. were practically out of print at the close of the year owing to the necessity of printing limited editions.

It should be mentioned here that the bulletins of the Agricultural Experiment Station are mailed free of postage by reason of the fact that the United States government, recognizing the fundamental value of agricultural research, appropriates annually a sum of money toward its support and permits the use of the franking privilege for Station publications.

The following is a tabular statement of the publications issued by the Station during the fiscal year:

Bulletin No.	Number of pages.	Number of copies printed.	Total number of pages in edition.
249	22	12,000	264,000
250	41	10,000	410,000
251	241	5,000	1,205,000
252	304	5,000	1,520,000
253	28	10,000	280,000
254	22	15,000	330,000
255	31	15,000	465,000
256	92	10,000	920,000
257	59	10,000	590,000
258	20	15,000	300,000
259	37	7,500	202,500
260	50	8,000	400,000
261	34	16,000	544,000
262	12	15,000	180,000
263	19	15,000	285,000
264	40	10,000	400,000
265	25	12,000	300,000
266	7	20,000	140,000
Circular 19	9	7,500	67,500
Circular 20	7	15,000	105,000
Circular 21	3	11,000	33,000
Circular 22	18	10,000	180,000
Circular 23	7	40,000	280,000
32nd Annual Report	28	6,000	168,000
1 unnumbered press bulletin	1	40,000	40,000
1 unnumbered press bulletin	1	40,000	40,000
Total—26	1158	380,000	9,649,000

*Since the preparation of this report and before its publication, the demand for bulletins as indicated by individual personal requests in writing, has increased to more than 12,000 bulletins per month and the mailing list on July 1, 1921, stood at 53,800 names.

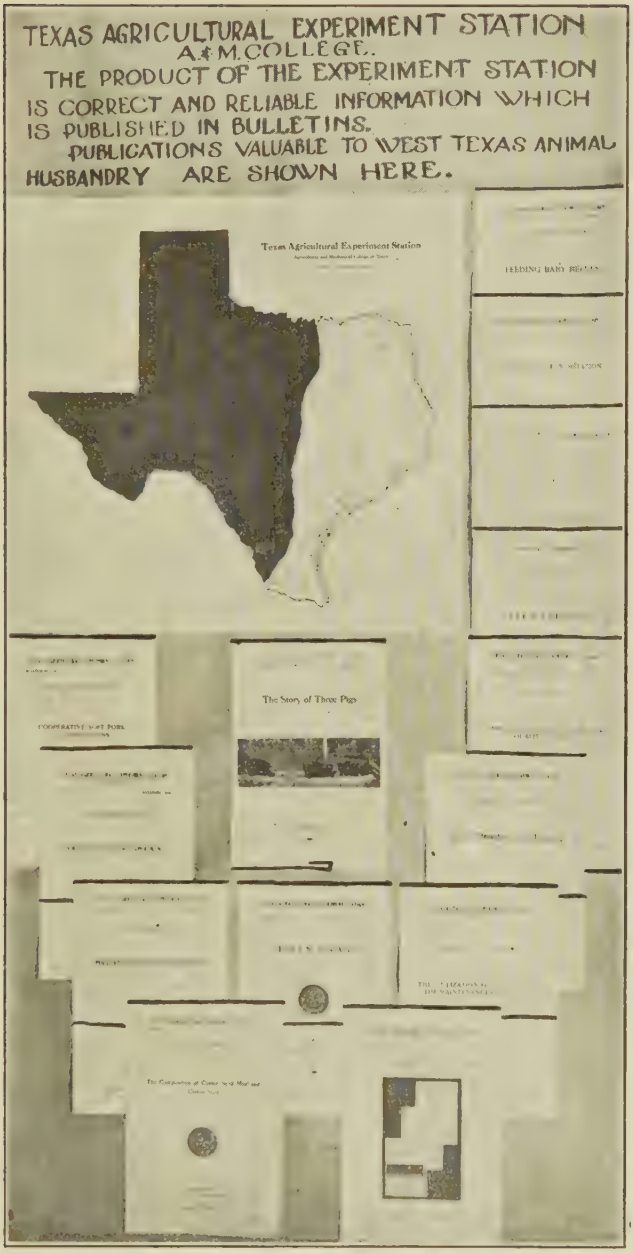
TEXAS AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE.
THE PRODUCT OF THE EXPERIMENT STATION
IS CORRECT AND RELIABLE INFORMATION WHICH
IS PUBLISHED IN BULLETINS.
PUBLICATIONS VALUABLE TO WEST TEXAS ANIMAL
HUSBANDRY ARE SHOWN HERE.
Texas Agricultural Experiment Station
The Story of Three Pigs

Figure 31.

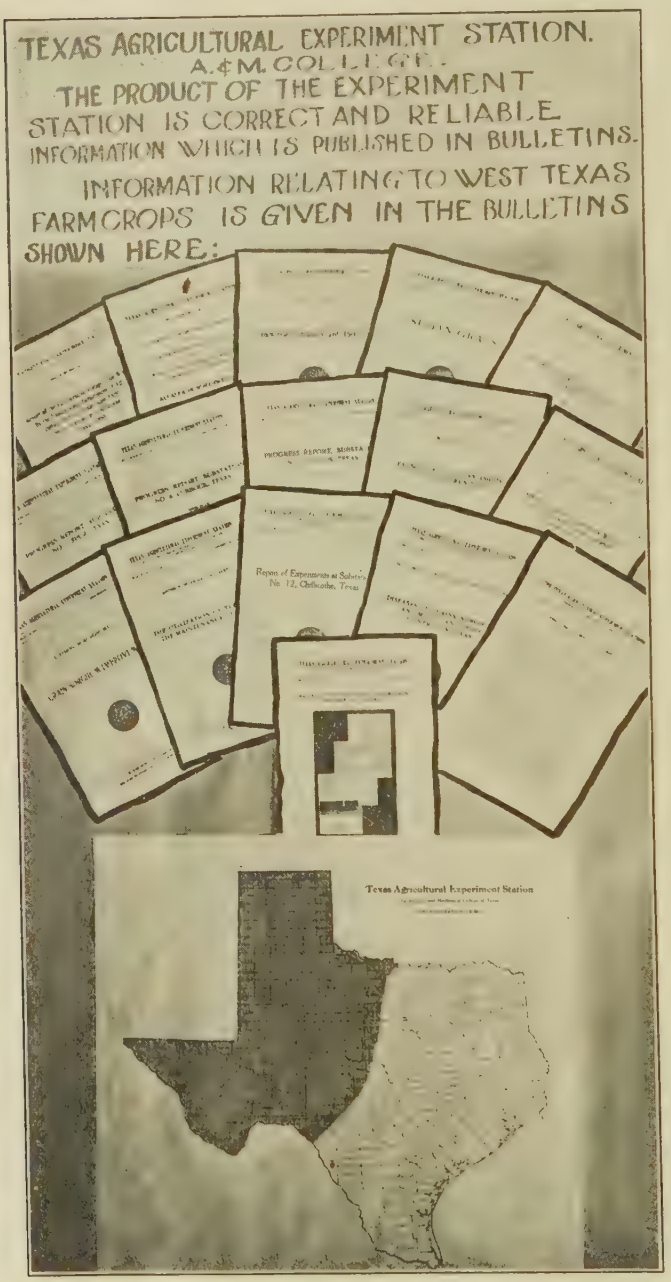
TEXAS AGRICULTURAL EXPERIMENT STATION.
A. & M. COLLEGE.
THE PRODUCT OF THE EXPERIMENT
STATION IS CORRECT AND RELIABLE
INFORMATION WHICH IS PUBLISHED IN BULLETINS.
INFORMATION RELATING TO WEST TEXAS
FARM CROPS IS GIVEN IN THE BULLETINS
SHOWN HERE:
Texas Agricultural Experiment Station

Figure 32.

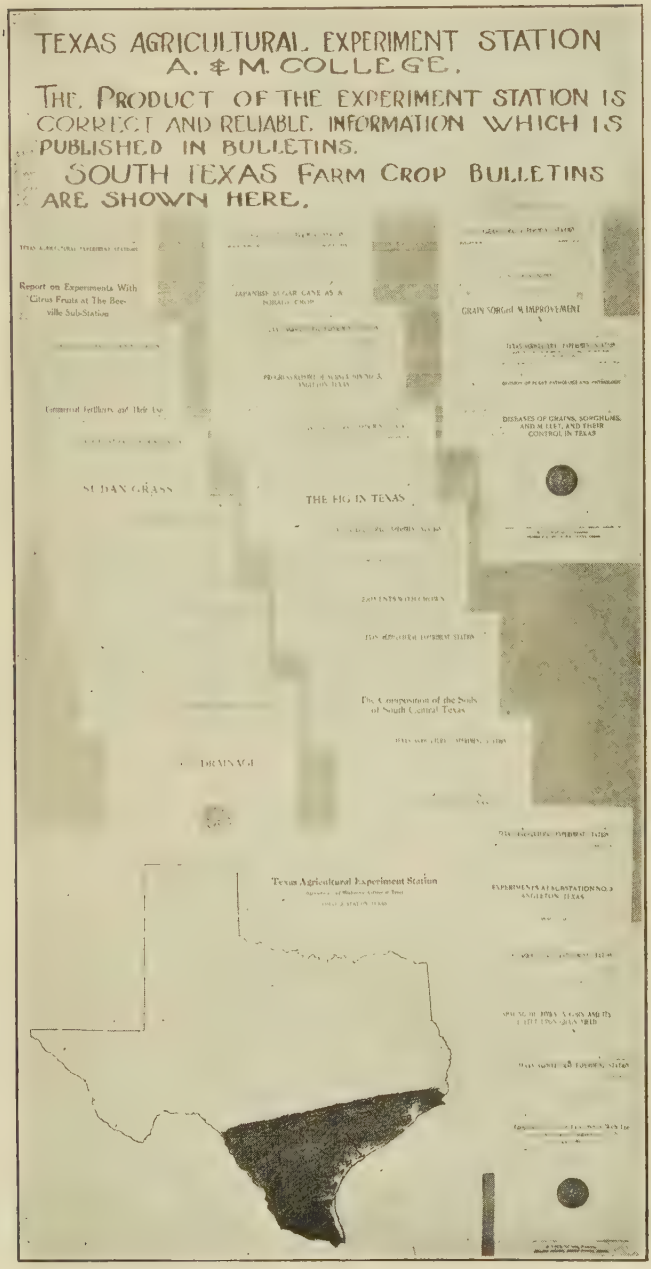
TEXAS AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE.
THE PRODUCT OF THE EXPERIMENT STATION IS CORRECT AND RELIABLE INFORMATION WHICH IS PUBLISHED IN BULLETINS.
SOUTH TEXAS FARM CROP BULLETINS ARE SHOWN HERE.
Report on Experiments With Citrus Fruits at The Beeville Sub-Station
GRAIN SORGO IMPROVEMENT
DISEASES OF GRAINS, SORGHUMS, AND MILLET, AND THEIR CONTROL IN TEXAS
SUDAN GRASS
THE FIG IN TEXAS
The Composition of the Soils of South Central Texas
Texas Agricultural Experiment Station

Figure 33.

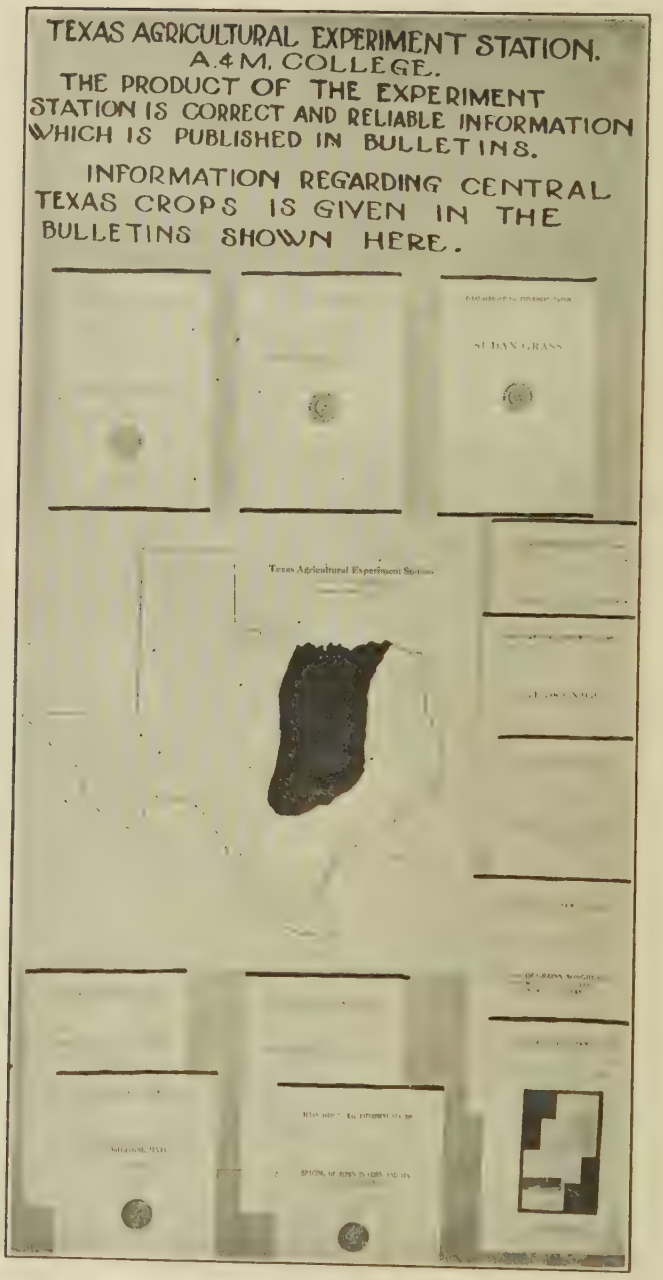
TEXAS AGRICULTURAL EXPERIMENT STATION.
A.&M. COLLEGE.
THE PRODUCT OF THE EXPERIMENT STATION IS CORRECT AND RELIABLE INFORMATION WHICH IS PUBLISHED IN BULLETINS.
INFORMATION REGARDING CENTRAL TEXAS CROPS IS GIVEN IN THE BULLETINS SHOWN HERE.

Figure 34.

FIGURE 35.—New farm facts being mailed out to the citizens of Texas. Mailing Room at Main Station.

FINANCIAL STATEMENT

A detailed financial statement of all funds handled by the Texas Agricultural Experiment Station system during the year is given in the following pages. The fiscal year for the Federal funds (Hatch and Adams funds) is from July 1, 1919, to June 30, 1920. The fiscal year for State appropriations and all other funds is from September 1, 1919, to August 31, 1920. The financial schedules which follow are based upon the above designations of the fiscal year:

FUNDS AVAILABLE

From United States Treasurer for the year ending June 30, 1920, Hatch Fund	$ 15,000.00
From United States Treasurer for the year ending June 30, 1920, Adams Fund	15,000.00
From State Treasurer for the year ending August 31, 1920, Substations	90,020.00
From State Treasurer for the year ending August 31, 1920, Main Station	108,020.00
From Substation Treasury for the year ending August 31, 1920, Substation Treasury	62,892.11
From Main Station Treasury for the year ending August 31, 1920, Main Station Treasury	14,960.54
Total	$ 305,892.65

FEDERAL FUNDS

Hatch Fund	Debit	Credit
Received from the United States Treasurer	$ 15,000.00	
Salaries		$ 11,120.92
Labor		2,041.61
Postage, stationery and office supplies		180.36
Freight and express		43.66
Heat, light and water		22.00
Chemical and laboratory supplies		204.16
Seeds and plants		162.10
Feed stuffs		90.65
Library		41.50
Tools, machinery and implements		605.65
Scientific apparatus		91.48
Live stock		295.00
Contingent expenses		20.00
Repairs on buildings		80.91
Total	$ 15,000.00	$ 15,000.00

Adams Fund	Debit	Credit
Received from the United States Treasurer	$ 15,000.00	
Salaries		$ 9,482.16
Labor		2,117.49
Postage, stationery and office supplies		53.27
Freight and express		143.78
Chemical and laboratory supplies		1,253.68
Seeds and plants		340.73
Feed stuffs		17.55
Library		15.25
Tools, machinery and implements		215.92
Furniture and fixtures		201.99
Scientific apparatus		480.02
Live stock		299.25
Traveling expenses		39.63
Repairs on buildings		339.28
Total	$ 15,000.00	$ 15,000.00

Main Station Treasury Fund	Debit	Credit
Received from Sales	$ 14,960.54	
Division of Agronomy		$ 364.87
Division of Entomology		206.32
Division of Plant Breeding		80.00
Division of Veterinary Science		2,416.54
Division of Chemical Analyses		9,941.40
Division of Feed Control Service		7.80
Division of Horticulture		33.25
Division of Plant Pathology and Physiology		2.97
Photographic		779.14
General		45.42
Balance (unexpended)		1,082.83
Total	$ 14,960.54	$ 14,960.54

SUMMARY

Total sales	$ 14,960.54	
Total expenditures		$ 13,877.71
Balance		1,082.83
Total	$ 14,960.54	$ 14,960.54

STATE FUNDS

Substations	Appropriations
No. 1. Beeville, Texas	$ 4,675.00
No. 2. Troup, Texas	5,270.00
No. 3. Angleton, Texas	5,225.00
No. 4. Beaumont, Texas	5,220.00
No. 5. Temple, Texas	4,850.00
No. 6. Denton, Texas	5,490.00
No. 7. Spur Texas	8,355.00
No. 8. Lubbock, Texas	7,400.00
No. 9. Pecos, Texas	6,235.00
No. 10. Feeding and Breeding Station, College Station, Texas	16,600.00
No. 11. Nacogdoches, Texas	4,900.00
No. 12. Chillicothe, Texas	3,020.00
No. 14. Sonora, Texas	12,880.00
Total	$ 90,020.00

Main Station	Appropriations
Veterinary Science	$ 5,410.00
Horticulture	1,900.00
Entomology	17,630.00
Agronomy	8,010.00
Plant Pathology and Physiology	2,250.00
Forestry	1,500.00
Plant Breeding	1,850.00
Animal Industry	3,450.00
Soil Survey	7,500.00
Publications	7,500.00
General Expenses	8,000.00
Salaries	39,020.00
General Reserve	4,000.00
Total	$ 108,020.00

Substation Treasury Fund	Debit	Credit
Received from Sales	$ 62,892.11	
No. 1. Beeville, Texas		$ 1,125.30
No. 2. Troup, Texas		375.79
No. 3. Angleton, Texas		642.28
No. 4. Beaumont, Texas		998.06
No. 5. Temple, Texas		646.44
No. 6. Denton, Texas		2,092.24
No. 7. Spur, Texas		2,128.96
No. 8. Lubbock, Texas		1,484.66
No. 9. Pecos, Texas		845.39
No. 10. Feeding and Breeding Station		46,064.25
No. 11. Nacogdoches, Texas		338.03
No. 12. Chillicothe, Texas		1,171.38
No. 14. Sonora, Texas		2,312.07
Animal Industry		3,080.53
Soil Survey		962.77
General		386.08
Deficit	1,762.12	
Total	$ 64,654.23	$ 64,654.23

SUMMARY

Total sales	$ 62,892.11	
Total expenditures		$ 64,654.23
Deficit	1,762.12	
Total	$ 64,654.23	$ 64,654.23

STATE FUNDS

Classification of Expenditures	Debit	Credit
Received from State Treasurer (State appropriations)	$ 198,040.00	
Salaries		$ 78,694.14
Laboratory assistants		1,969.02
Labor		38,505.47
Publications		5,318.83
Exhibits		107.61
Postage, stationery and office supplies		5,414.72
Freight and express		587.81
Furniture and fixtures		1,115.37
Chemical and laboratory supplies		3,673.47
Seeds and plants		3,167.57
Feed stuffs		3,249.60
Fertilizers		150.00
Library		398.15
Tools, machinery and implements		5,157.44
Fire apparatus		133.70
Veterinary fees		25.00
Irrigation system		1,150.00
Soil survey		7,500.00
Scientific apparatus		1,368.02
Live stock		2,000.00
Repairs on buildings		3,897.12
Permanent buildings		6,931.31
Traveling expenses		7,169.11
Miscellaneous items		4,682.61
Balance not vouchered (as of August 31, 1920)		15,673.93
Total	$ 198,040.00	$ 198,040.00

SUMMARY

	Appropriations
Total Substations	90,020.00
Total Main Station	108,020.00
Total State appropriations	$ 298,040.00

INVENTORIES

Substations	Value
No. 1. Beeville, Texas	$ 26,130.10
No. 2. Troup, Texas	32,502.01
No. 3. Angleton, Texas	19,875.66
No. 4. Beaumont, Texas	21,041.87
No. 5. Temple, Texas	33,007.00
No. 6. Denton, Texas	48,661.90
No. 7. Spur, Texas	34,933.76
No. 8. Lubbock, Texas	25,604.70
No. 9. Pecos, Texas	33,871.75
No. 10. Feeding and Breeding Station, College Station, Texas	101,837.58
No. 11. Nacogdoches, Texas	19,151.95
No. 12. Chillicothe, Texas	23,080.42
No. 14. Sonora, Texas	110,862.56
Total	$ 430,561.26

Main Station	Value
Veterinary Science	$ 20,377.60
Horticulture	4,437.14
Entomology	7,284.99
Plant Pathology and Physiology	5,604.03
Plant Breeding	3,674.99
Agronomy	33,201.41
Animal Industry	14,047.39
Forestry	18.56
Chemistry	6,747.99
Feed Control Service	2,912.13
Farm and Ranch Economics	292.41
Photographic	1,099.22
General	24,109.95
Total	$ 123,807.81

SUMMARY

	Value
Total valuation of Substation properties	$ 430,561.26
Total valuation of Main Station properties	123,807.81
Total valuation of all Experiment Station properties	$ 554,369.07

The above inventory valuation does not include 1040 acres of College land and two (2) buildings on the College campus, used by the Station system, and worth approximately $300,000.

FEED CONTROL SERVICE FUND

Accounts	Debit	Credit
Tax collections (inspection tax tags)	$ 75,434.86	
Salaries		$ 20,832.39
Labor		1,179.60
Tag account		30,192.74
Postage, stationery and office supplies		1,153.28
Freight and express		412.02
Traveling expenses (inspectors)		9,308.27
Furniture and fixtures		183.00
Refund on tags		1,493.64
Repairs on buildings		512.88
Publications		4,176.10
Analyses		11,678.63
Deficit	5,678.69	
Total	$ 81,122.55	$ 81,122.55

SUMMARY

Working fund (advanced)	$ 10,000.00
Inventory (tax tags on hand)	6,683.30
C. O. D. orders (outstanding)	755.96
Total	$ 17,439.26

COLLEGE STATION, TEXAS, August 31, 1920.

Director B. Youngblood, College Station, Texas.

DEAR SIR: I do solemnly swear that the foregoing report upon the receipts and disbursements of the several funds devoted to development, maintenance and the support of the Texas Agricultural Experiment Station and its thirteen (13) substations, is just and correct, and that the funds have been expended in accordance with the Federal and State laws, to the best of my knowledge and belief.

(Signed) CHAS. A. FELKER,
Chief Clerk.

Subscribed to and sworn before me, A. S. Ware, a notary public in and for Brazos County, Texas, on the 31st day of August, A. D. 1920.

(Signed) A. S. WARE,
(Seal) Notary Public in and for Brazos County, Texas.